EIGHTH VERMONT AGRICULTURAL REPORT

BY THE

STATE BOARD OF AGRICULTURE,

FOR

THE YEARS 1883--84.

HIRAM A. CUTTING, M. D., PH. D.,
SECRETARY OF THE BOARD.

MONTPELIER:
WATCHMAN & JOURNAL PRESS.
1884.

VEGETABLES.

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AN ACT ESTABLISHING THE VERMONT BOARD OF AGRICULTURE.

It is hereby enacted by the General Assembly of the State of Vermont:

SEC. 1. The Governor of the State, the president of the University of Vermont and State Agricultural College and six other persons appointed by the Governor and confirmed by the Senate, who shall hold their office until the first day of December in that year in which the regular biennial session of the General Assembly occurs next after their appointment, shall constitute the Vermont Board of Agriculture, for the improvement of agriculture and the general interests of husbandry, and the promotion of agricultural education throughout the State. In case of vacancy in the Board by reason of death, resignation, or removal from the State of any member, or from any other cause, the Governor shall fill the vacancy by appointment as in other cases.

SEC. 2. The members of the Board shall receive two dollars per day each and their expenses necessarily incurred in the discharge of duties. They shall designate one of their number who shall serve as secretary, and the entire expense of the Board shall not exceed twenty-five hundred dollars annually.

SEC. 3. The Board shall hold one meeting in each county in this State annually, and may hold as many more as it shall deem expedient, either independently or in connection with any society, association or other organization devoted to the same general object, and may in its discretion employ lecturers, essayists, or other aids in the conducting of its affairs, and shall, as far as may be practicable, aid and encourage State and local associations and societies.

SEC. 4. The secretary shall prepare on or before the thirty-first day of July of that year in which the regular biennial session of the General Assembly is held, a detailed report of the proceedings of the Board, with such suggestions and recommendations as the interests of agriculture may require, and may append thereto such abstracts of the proceedings of the several agricultural societies, dairymen's associations and farmers' clubs in the State as the Board shall deem advisable. The report shall be printed in such manner as the Board shall direct and such number as they shall deem advisable, five hundred copies of which shall be for the use of the State Librarian and General Assembly, and the remainder shall be distributed under the direction of the Board. The expense of printing the report shall be included in the appropriation made in section two of this act.

SEC. 5. An act entitled "An act establishing a State Superintendent of agricultural affairs," approved November 26, 1878, is hereby repealed.

SEC. 6. This act shall take effect from its passage.

Approved December 23, 1880.

MEMBERS

OF THE

STATE BOARD OF AGRICULTURE.

1883-84.

His Excellency, JOHN L. BARSTOW, Sheldon, *Chairman.*
Dr. HIRAM A. CUTTING, Lunenburgh, *Secretary.*
MATTHEW H. BUCKHAM, Pres. Agricultural College, Burlington.
HENRY LANE, Cornwall.
E. M. GOODWIN, Hartland.
M. W. DAVIS, Westminster, (P. O. Address, Bellows Falls.)
E. R. PEMBER, Wells.
E. R. TOWLE, Franklin, (P. O. Address, West Berkshire.)

In the winter of 1884 Loren P. Smith, of Trumansburg, N. Y., was furnished, for one month, by the Agricultural College of Vermont to attend the Institute Meetings of the Board, and lecture at the same.

FORMER BOARDS.

1871–72.

His Excellency, John W. Stewart.
James B. Angell, President State Agricultural College.
Peter Collier, Secretary of the Board.

A. B. Halbert, Essex.	Pitt W. Hyde, Castleton.
Charles H. Heath, Plainfield.	Z. E. Jameson, Irasburgh.
Frederick Holbrook, Brattleb'o.	Noah B. Safford, W. R. Junct'n.

1873–74.

His Excellency, Julius Converse.
Matthew H. Buckham, Pres. State Agricultural Col.
Peter Collier, Secretary of the Board.

A. B. Halbert, Essex.	Pitt W. Hyde, Castleton.
Charles H. Heath, Montpelier.	Z. E. Jameson, Irasburgh.
Francis D. Douglass, Whiting.	Thos. H. Hoskins, Newport.

1875–76.

His Excellency, ASAHEL PECK.
MATTHEW H. BUCKHAM, Pres. State Agricultural Col.
PETER COLLIER, Secretary of the Board.
HENRY M. SEELY, Secretary of the Board.

THOMAS L. SHELDON, Rupert.	C. HORACE HUBBARD, Springfi'd.
ALEXIS T. SMITH, New Haven.	GARDNER S. FASSETT, Enosburgh.
JOHN B. MEAD, Randolph.	CYRUS G. PRINGLE, Charlotte.

JOHN H. MEAD, West Rutland.

1877–78.

His Excellency, HORACE FAIRBANKS.
MATTHEW H. BUCKHAM, Pres. State Agricultural Col.
HENRY M. SEELY, Secretary of the Board.

GARDNER S. FASSETT, Enosburgh.	JOHN H. MEAD, West Rutland.
*PETER COLLIER, Burlington.	ORA PAUL, Pomfret.
ALBERT CHAPMAN, Middlebury.	HENRY CHASE, Lyndon.

1879–80.

Under change of law, John B. Mead, of Randolph, was "Superintendent of Agricultural Affairs."

1881.

His Excellency, ROSWELL FARNHAM, Bradford, *Chairman.*
Dr. HIRAM A. CUTTING, Lunenburgh, *Secretary.*
MATTHEW H. BUCKHAM, Pres. Agricultural College, Burlington.
HENRY LANE, Cornwall.
E. M. GOODWIN, Hartland.
M. W. DAVIS, Westminster, (P. O. Address, Bellows Falls.)
H. F. LOTHROP, Pittsford.
GARDNER S. FASSETT, Enosburgh.

JOHN B. MEAD, of Randolph, was first appointed upon the Board, with the expectation that he would act as its Secretary, for which his previous acceptable service as "Superintendent of Agricultural Affairs of Vermont," specially fitted him. On account of other business he resigned and Gardner S. Fassett was appointed by the Governor to fill the vacancy, before the organization of the Board. H. F. Lothrop and Gardner F. Fassett resigned at the close of the first year, on account of ill health of themselves or families.

1882.

His Excellency, ROSWELL FARNHAM, Bradford, *Chairman.*
Dr. HIRAM A. CUTTING, Luneuburgh, *Secretary.*
MATTHEW H. BUCKHAM, Pres. Agricultural College, Burlington.
HENRY LANE, Cornwall.
E. M. GOODWIN, Hartland.
M. W. DAVIS, Westminster, (P. O. Address, Bellows Falls.)
E. R. PEMBER, Wells.
E. R. TOWLE, Franklin, (P. O. Address, West Berkshire.)

*Prof. P. Collier declined his appointment as member.

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REPORT OF THE SECRETARY.

To the Chairman and Members of the Board of Agriculture of the State of Vermont:

Your Secretary herewith submits the following report of the work of the Board for the years 1883–84. This has consisted largely in holding Institutes in the various counties as provided by law and also in connection with the "Dairyman's Association," the "Industrial Association" at Poultney, and the State Grange. Most of the Institutes have been full two days' meetings, but in two or three instances less time has been given. At these Institutes and elsewhere the addresses and discussions have been mostly connected with agriculture, and always possessed an agricultural interest.

By requirements of the law we were to hold two meetings in each county since our last Report, and as many more as we could do with the limited fund under our control. Such other Institutes have been held where there was the most urgent demand for them, or where we thought they would do the most good.

The attendance has usually been large; always fair. The average attendance has been much larger than during the two previous years.

We have held forty-seven meetings, distributed by counties as follows:

Addison	5
Bennington	4
Caledonia	4
Chittenden	3
Essex	2
Franklin	4
Grand Isle	2
Lamoille	2
Orange	3
Orleans	2
Rutland	5
Washington	3
Windham	4
Windsor	4

The whole number of addresses given at our Institutes and otherwise under our direction has been seven hundred thirty-one, all of which have been discussed more or less. Their average length has been forty minutes and the average length of discussion fifteen minutes. Our lectures have been advertised by posters and also by hand-bills containing programmes, of which the following is a sample:

INSTITUTE LECTURES

—AT—

TOWN HALL, SPRINGFIELD, VT.,

JANUARY 8th AND 9th,

UNDER THE DIRECTION OF THE

BOARD OF AGRICULTURE.

TUESDAY, JANUARY 8th.

10 A. M. Address of Welcome,
By C. HORACE HUBBARD of Springfield.

11 A. M. Reply,
By M. W. DAVIS of Westminster.

11:30 A. M. Fruit,
By F. W. BLANCHARD of Weathersfield.

AFTERNOON.

2 P. M. Breeding of Blooded Stock,
By HENRY LANE of Cornwall.

3 P. M. General Discussion,
Led by E. M. GOODWIN of Hartland.

EVENING.

7 P. M. Question box opened and discussion of questions,
By CUTTING and DAVIS.

8 P. M. Social Position of the Farmer,
By E. M. GOODWIN of Hartland.

WEDNESDAY, JANUARY 9th.

10 A. M. Milk,
By DR. H. A. CUTTING, Secretary.

11 A. M. Winter Feeding for Milk,
By LOREN P. SMITH of Trumansburgh, N. Y.

AFTERNOON.

2 P. M. Mexican Farming,
By H. M. ARMS of Springfield.

2:30 P. M. Drainage,
By J. R. WALKER.

3 P. M. Wastes of the Farm,
By M. W. DAVIS of Westminster.

EVENING.

7 P. M. Question Box opened and discussion of questions by the audience.

7:30 P. M. Fertilizers and Fertilization,
By DR. HIRAM A. CUTTING of Lunenburgh.

ALL LECTURES FREE.

Ladies and young people are especially invited to be present at all sessions. Subjects for discussion brought forward by the farmers in the form of questions, on slips of paper or orally, may be introduced. All present are invited to join in the discussions. Persons coming by cars to attend the meetings will receive return checks by applying to the Secretary.

HIRAM A. CUTTING, Secretary of Board.
Lunenburgh, Vermont.

The interests of these meetings have been aided by so many persons that their mention would be impossible, and the Board feel to thank the people at large for their general kindness which has made these Institutes such a success.

We take extracts from the address of welcome given us at our last meeting, by Edson A. Doud, Esq., of New Haven, as indications of our work and the interest therein.

He said:

Mr. Chairman and Gentlemen of the Board:

With, it seems to me, doubtful wisdom, I have been requested as one of the farmers of Addison County to speak to you a few words of greeting, and without apology or excuse, I address myself to the brief task. But preliminary to what of greeting I may utter I desire to say that I should do violence to my own feelings did I fail to express my appreciation of the enterprise and public spirit of the citizens of Middlebury in erecting so substantial and elegant a hall as the one in which we are met; and I also congratulate the Board and the citizens of Addison County that the generosity of Middlebury opens its doors to you and to us.

And now, Mr. Chairman and gentlemen, I find it less difficult to welcome you to-day from what seems to me to be the fact, namely, that a majority of Addison County farmers are not afraid of new ideas. They are a class of men who read, think, investigate, try, prove, and adopt new methods—if found worthy of adoption. They do not hesitate to test the merits of this new theory, because some other has proved fallacious. I believe, sir, that they ever stand in a receptive attitude towards any new truth or system of procedure that contains genuine merit. Neither are they blind to the fact that the world has not remained at a dead level from creation all along down the ages, but, on the contrary, they see that the history of mankind is the history of progress, and furthermore that nowhere is this more true than in so much of the history of the race as relates to agricultural pursuits. Lest this fulsome commendation seem overdrawn, let me also say that we have some "Ephraims" "who are wedded to their idols," men with sluggish brains and bad digestion—mental and physical—who practically, at least, with an incredulous shake of the head vociferate "Oh no, there's nothing new under the sun" of any value, "for since the fathers fell asleep all things remain as they were." But happily, sir, this latter class are a feeble minority, and therefore I take the greater pleasure in behalf of the former class in bidding you a cordial welcome, assuring you of a patient, interested and intelligent hearing. And, sir, we are all the more glad to have the Board among us at this time for having had you before. I am quite sure that the impression left in the County by previous meetings was one of satisfaction, and we now think that you have more and perhaps better things to impart than yon have yet given us.

There are those present who can appreciate in some degree the possibly embarrassing circumstances under which in 1881 you undertook this work. Some who had the privilege of taking part in the deliberations upon the bill, which, becoming a law, gave your honorable body the right to be, well remember the prejudice against the move. Former boards had in some measure fallen into disrepute. The one-man plan had proved unsatisfactory. Professional men and men of

other than agricultural vocations were inclined to give the cold shoulder to the farmers' bill. The debate closed with a ringing speech in its favor by the present State Superintendent of Education, a gentleman who has broad common sense enough to know that education for life's best work is not closed when the pupil emerges from the schoolhouse. The bill passed by seven or eight votes.

I have referred to these matters to call attention to the peculiar circumstances under which the duties of the Board were undertaken in 1881. The reluctance at that time to establish a Board of Agriculture was not, I apprehend, in any large degree, its cost, but a distrust of its usefulness, but I am glad to be able to say, that so far as I know, the expectations of the friends of the measure have been fully realized. The personnel of the Board has, I believe, remained unchanged for the four years, except by voluntary resignation,—a fact not only complimentary to its members but also to the good sense of the present executive.

And now, sir, we are here to learn. We wish to become "public benefactors by making two spears of grass grow where but one grew before." We wish to double, or at least largely increase, the product of our cereal grains. We desire to know how cheapest and best to care for our dairies and neat stock. We know a little about sheep, but are open to further information. And while we make some "gilt edge" butter, we would like it all to be of so high a grade that oleomargarine, butterine, lardine, or any other villainous counterfeit, will not be preferred instead. And not least, in these times when the enthusiasts who write up ensilage matters are holding high carnival in the newspapers, we would really like to know as near as practicable about the desirability of backing "sour creaut" from some subterranean pit, in order to attempt to cajole the old cow into the belief that it is summer all the year round! Upon all these matters and many beside we desire information. I say this not flippantly but in all seriousness. The time has passed for men of any vocation to plod on in the paths their fathers trod; or at least the simple reason alone that their paternal ancestors walked therein is not sufficient. Now-a-days men are expected to have a reason for the methods they adopt. There is no more pitiable and inconstant agricultural imbecile than the man who blindly copies some phase of the operations first of one successful husbandman and then another, without the most distant idea of the relation of the thing done to its original surroundings, or to his own necessities. Such exhibitions of incapacity are not uncommon. To labor to abolish them it seems to me, gentlemen, is a part at least of your work. And it also seems to me that both the teacher and the taught are thereby mutually honored. For this method of practical and actual education is bound to go on. These gatherings for discussion and interchange of views have, I believe, come to stay. Mind must and will rub against mind; thought be laid alongside of thought; suggestion be compared with suggestion, and by this constant attrition of ideas advanced methods and results will be attained.

Of course in this as in all other reforms, perfection, as perhaps large advancement, is not secured in a day. We may not notice much

improvement from year to year, but who will dare deny that from generation to generation agriculture has made and will make gigantic strides. I need not illustrate it; it is within the observation of all. Therefore, Mr. Chairman and gentlemen, we bid you welcome and rejoice in the opportunity. We feel a pride in being the citizens of a commonwealth that has provided for such occasions as this promises to be, and we bid you God speed in the further duties of your office. That you may yet for many years be permitted to give your fellow citizens the benefit of your long experience and observation is the hearty wish of us all.

I now report the opinions of different persons as expressed at our meetings on various subjects, classifying them under leading heads, that they may the more readily be found when wanted.

BIRDS AND INSECTS.

WASHINGTON INSTITUTE.

Mr. Walker, of Chelsea, says the grasshoppers eat up his pastures, and so he keeps turkeys to eat them up; asks if anything is better.

Mr. Davis said crows were a first-class bird for grasshoppers. Others did not like the crow.

Question. Should we protect English sparrows and robins?

Dr. Cutting said that the English sparrow had friends as well as enemies. That it eat both seeds and insects. It was a road scavenger, and many of the insects that infested the intestines of the horse were being decimated by its untiring search. While it depredated grain fields in some sections, it was perhaps second to the robin, which was a bird beloved almost everywhere, yet one of our most expensive luxuries, and it does not require much observation to show him one of our worst foes. The result of your observations will surprise you. A robin will eat a full half pint of cherries and small fruits each day during their season, and pecks, and thus destroys as many more. The "New York Examiner" sums up the damage of a single robin in a season at $3.30, which shows them an expensive luxury. In the way of worms it hardly touches other than the earth worm, which are valuable to the farmer, and hence adds more debt to his balance sheet. Brown thrushes and catbirds are hardly behind him in cost of their depredations. I have noticed various devices to keep them from cherry trees and strawberry patches, but a spry cat and a lively boy with a shot gun are about the only reliable measures. As the law forbids the shot gun I harbor two cats to make up the deficiency. One toad in your garden, or on your farm even, is worth more than a brace of any kind of birds and never do harm.

Mr. Davis says he feeds the crow and believes him a trusty friend. If well fed he will not pull corn but eat an immense number of worms and grubs. Mr. Towle thinks well of the toad and would put a piece of board on some bricks laid flat that he might find a convenient house and be also protected from danger.

Dr. Cutting said that to watch the habits of birds and keep a debt and credit sheet was the true way to decide. A good spy glass could be used many times to advantage in watching them, and thus learning whether their acts were good or evil.

The discussion brought out also the facts that owls and skunks were very useful, and not to be persecuted as enemies.

BEES.

MIDDLEBURY INSTITUTE.

J. E. Crane of Middlebury, spoke upon the "Bee Industry." As showing how its importance had increased, he stated that in 1862 the value of honey produced was $2,000,000 and in 1882 it was $32,000,000. He contrasted the old style of hives and method of handling bees with the present, and exhibited a little book, which was the first book on bee-keeping published in the United States. It was printed at Middlebury about fifty years ago. Now there are a dozen or more journals devoted to this interest. About 1850 the moveable frame hive was invented. It had been the most valuable addition to the facilities of the bee-keeper ever produced, as it gives the keeper entire control of the bees. In 1860 Mr. Parsons of Flushing, L. I., imported the first Italian bees, which have proved very valuable. The Cyprian bee, the Egyptian bee and the Palestine bee have all been tried, but in the speaker's opinion none of them was as good as the Italian. In 1867 the honey extractor was brought out. By its use the honey is extracted and the comb returned to the hive. This has largely increased the honey product, as it costs the bees as much labor to make the comb as to make the honey. The process of making comb from a foundation was patented in 1860, but not made practicable till ten years later. By this process the foundation of the comb is made for the bees and by them drawn out in from twenty-four to forty-eight hours, saving them much time which can then be given to gathering honey. Bees can be handled perfectly by smoke so there is no danger from stings. Among the appliances of the apiary are bee cages for sending queens to a distance, and wax extractors which do away with all the disagreeable features of making wax by the old methods. Bee-keepers have long looked for a hive that would not swarm, but as yet no one has ever succeeded in planning such a hive. Bee-keeping, like every other business, has its drawbacks, among which is that known as "foul brood," a disease which kills the young bees before they leave the cells, and, being contagious, sometimes destroys whole apiaries. About one year in five is a total failure, the bees not gathering honey to live upon and must be fed, and large numbers of them die. In Addison County the business has rapidly grown for the past fifteen years, and last year one hundred thousand pounds of honey were sold outside of the county. It used to be thought the market would be easily overstocked, but that is not the case now. In 1860 the New York market broke down with twenty thousand pounds. Last year nearly one million pounds were sold in that market, and the demand everywhere is constantly increasing.

BREEDING.

This subject has been much discussed, and I will reduce it to what seems a few common place remarks, and as I believe it embodies the whole. Breed for the use you wish full bloods or grades as seems best for your special purpose. Against one temptation the farmer ought to take heed. When he has a promising male on hand he is very likely to imagine and his neighbors will also if friendly urge him to keep such a fine specimen for breeding purposes. In many cases of course this judgment is correct. But in the great majority of instances it is otherwise. It is of the greatest importance that we breed only from male stock of established superiority. The question is not simply whether a particular male has desirable qualities, but combined with this is the still more important query whether he has received these good points from a long line of desirable ancestors, and has them so firmly established that he can transmit them with a great degree of certainty. If this can be answered in the affirmative the male which is so unusually promising should be kept for a breeder. If his good points are purely accidental there can be no certainty and little probability that he will transmit them.

In fine, a poor specimen of a male with good ancestry is more likely to beget good stock, than a remarkably fine one with bad ancestry. If this was always in mind it would save much disappointment and loss. It is said that Vermont produces the best cattle, horses and sheep.

This simply means that Vermonters possess the greatest intelligence. It is mind that tells every time.

CORN.

FAIRFAX INSTITUTE.

Lecture by Mr. Goodwin on the culture of Indian corn. Would recommend the study of the growth of the corn plant to young people, as its growth is wrapped in mystery from its time of germination until it is ripened. The first formed ears are never the most perfect, and so would not recommend picking the first ripened ears for seed. By a careful selection of seed any variety of corn may be changed from an earlier to a later, and vice versa. Explained in an interesting manner the way by which corn mixes, one variety with another. The pollen of one variety, the flower of the tassel falling upon the silk of another. The same rules which apply in the breeding of live stock hold equally true in the raising and breeding of any variety of corn. Our yellow corn grown in tbe west becomes the dent, a peculiarity which is owing to climatic influences. Would not raise a too large growing variety, but one that is compact in its growth; ear not too large, with kernels close together, and sure to ripen. Prefers sod land for corn, and would insist that it be thoroughly done, with no balks. On a heavy soil would plow in the fall, spread on manure in

the winter on the snow; would not put on more than twelve loads, or four or five cords of manure, to the acre. In the spring put on the disc harrow for planting. Marks in rows $3\frac{1}{2}$ feet apart. Uses a corn planter guaged to drop as many kernels as he wishes, and makes the hills from eighteen inches to two feet apart. Would rather have his corn planted with a machine than with a hoe. After the corn appears above the ground puts on a light harrow with half-inch teeth, starting backward at an angle of 45 degrees, which destroys all the weeds and does not injure the corn. If the ground is very weedy a second harrowing will be necessary in a few days. As the corn gets larger uses a cultivator, going over the ground once in four or five days, or more, according to the weather, till the tassels begins to appear. At this time the roots begin to fill the ground, and so completely that not a square inch of soil can be found but is filled with roots. Would never hill corn. Would cut corn as soon as the kernels are glazed, not waiting for it to fully mature. Binds the corn in bundles and sets several together round a standing hill, they cannot blow, over and thus making them convenient to handle. Puts on fertilizers broadcast. *Would never* put it in the hill. Mr. Rowe inquires if it is more profitable to put the phosphate on in March than just before planting? Thinks it is. Does not believe in plowing under manure generally; would have it covered from two to three inches deep.

FERRISBURGH INSTITUTE.

Mr. Davis said: The possibilities of this crop seem almost incredible. One hundred bushels to the acre would have been questioned a few years ago, but now we have from the farm of the editor of the *Rural New Yorker*, on Long Island, a yield of $113\frac{69}{100}$ bushels per acre for four acres; C. F. Bowditch of Framingham, Mass., $17\frac{1}{2}$ acres averaging $109\frac{3}{4}$ bushels. One of the prize boys, in Manchester, Vt., raised at the rate of 127 bushels, but I am not expecting you will do this; but raise 50 bushels of good sound corn, and if for soiling or ensilage 20 to 25 tons of the green fodder to the acre.

Prof. Collier of Washington, chemist for the Agricultural Department, has shown that good sugar can be made from the cornstalk after the crop is gathered. Whether it will become a source of profit to the Vermont farmer may be in doubt, but it may be worth their consideration.

Hon. F. D. Douglass of Whiting, acknowledged that he made a great mistake when, some years since, he told the farmers they could not raise corn but to buy it and raise and sell something else from the farm. But now he advised them to raise their own corn; he could raise it for twenty-five cents a bushel or less, giving his method.

HIGHGATE INSTITUTE.

Mr. Goodwin practices spreading manure on the surface in winter, and finds that, in addition superphosphate or dissolved bone and ashes, will help materially in obtaining a satisfactory crop. Believes that we can with our improved appliances raise corn nearly as cheap as it

can be done at the West, and we should endeavor as far as we can to raise sufficient for our own use, thus saving much money. He uses phosphates on a clay soil and with good success. If a man has plenty of stable manure would not use commercial fertilizers, and would not apply too much of this for one crop. Would not hill up corn in cultivating. Does not find that manure spread in winter runs off with the melting snows, as some would seem to think.

Mr. Hoadly on a gravelly soil finds it best to plow just before planting, otherwise the wire worms do much injury. Farmers on the sandy soils about here practice plowing in the spring.

L. E. Pelton plants twelve rowed corn. Plows under coarse manures and would harrow in fine manure on the surface. Generally plows in the spring. Does not put manure in the hill. Dr. Baxter stated that more corn is raised in Highgate than in any other town in the county, and this is largely raised on land without manure. Mentioned one farmer, a Mr. Allen, who last year raised twenty-two hundred bushels of ears of corn. One farmer plants corn on the same land two years in succession, then raises rye one year, after which it is allowed to remain idle for three years. It is then ready for another turn with corn and rye. Twenty-five bushels of shelled corn per acre is a good average crop. This land is worth from $5 to $8 per acre. Does not consider corn on this soil a very exhausting crop, not so much so as oats.

MANCHESTER INSTITUTE.

The first paper was on "Indian Corn Culture," read by E. M. Goodwin of Hartland.

Rev. Dr. Wickham has corn from Central Illinois; will it grow?

E. M. Goodwin—It can be made to grow here by care; it can be acclimated.

What variety does Mr. Goodwin raise?

E. M. Goodwin—The Stowe; moderate sized ear, well filled. The shortest period in which he has succeeded in growing it is ninety days. Frost bitten corn should stand a few days before cutting.

Mr. Nichols prefers cutting and letting it lie on the ground a few days; then he would bind it up and set it up in large stooks. It makes some extra work but the fodder is worth enough more to pay for it. He cuts bundles of fodder corn and uses them for binding up the stooks.

E. M. Goodwin can make corn stand up better without a horse and do the work faster. He wouldn't plow under manure. Always plows in the fall seven inches deep.

Mr. Bottom of Shaftsbury, had plowed in fall and top dressed and plowed in spring turning under manure. He had about two-thirds as much corn on the fall plowed land as on the spring. He had an extra crop of wild carrots on the fall plowing.

Mr. M. W. Davis would never lay corn on the ground; it is too slow and too much labor. Always cuts and sets around a standing hill.

MIDDLEBURY INSTITUTE.

Lyman W. Peet of Cornwall, said: The fertile soil of the Western States offers great attractions, and numbers were attracted from New England. Some succeeded, and others did not. The West has its disadvantages as well as the East. The fact was the poverty, and not the richness of the East had been too much talked of. The census reports showed that the yield of corn per acre in the best of the Western States was but 32¼ bushels, while in New England the product was 35½ bushels. And the same ratio nearly holds with regard to the other grains.

Mr. N. G. Pierce of Westminster, says, that in my experiments I have learned that with the rows three feet ten inches distant from each other both ways, that four stalks in each hill is not too numerous, and, in fact, that number gives the best results. When a scarcity of home-made manures exists, I should favor the purchase of first-class phosphates by those who can afford their use. In any event, however, considering the comparative expense of the phosphate and the home-made compost, and also the probable benefits to future crops, I should urge every farmer to husband his home manurial resources. Let him commence at once and build up as large and as rich a compost heap as time and circumstances will permit. The quantity of such valuable material within the reach and control of every farmer will happily surprise those who have not had practical experience in making compost heaps.

PITTSFORD INSTITUTE.

Mr. Douglass of Pittsford, has had the best success with the twelve rowed corn, and thinks he can raise one-third more bushels than of the eight rowed. Mr. Winslow of Chittenden, has had the best results from the eight rowed. Further discussion followed by others during which it was brought out that analysis had shown that our Vermont corn was worth as much ground cob and all, pound for pound, as Western corn clear.

SOUTH HERO INSTITUTE.

The afternoon session was taken up by the discussion of the topic, "The Culture of Indian Corn," By E. M. Goodwin.

Mr. Allen inquired how deep he would plant corn. About 1½ inches; if the ground was very dry would plant deeper. Would prefer planting in drills instead of hills, can get more stalks on an acre and a larger yield.

Would cultivate as deeply as possible without seriously injuring the roots, and discontinue about the time the tassels appear.

Does the burning of corn cobs effect their manurial value? Not materially, but would prefer to have them ground and fed and carried to the land in that way.

WASHINGTON INSTITUTE.

Mr. Davis said: The question naturally arises, can we raise corn? to which he said yes, and then how to raise more was the question.

First, be sure you have good corn land, a warm sandy loam with an incline to the south, then plow it in the fall and manure it on top in winter, thoroughly pulverizing and working up the land in the spring with a Randall harrow, and be sure it is thoroughly pulverized. Then go over it with a Thomas harrow to make it smooth, after which the land should be rolled to compress it so the life will not be dried out by the wind and sun. Plant only when the weather is most favorable for the rapid germination of the seed, and plant in drills in a straight line so a cultivator can be run close to the row and not hit a hill. When up four or five inches go over it with a Thomas harrow, that will kill all the weeds but will not hurt the corn at all. After it gets up one or two feet then put in a Blanchard cultivator and that does all the hoeing necessary for the corn. As to what should be used to stimulate the growth of corn it is impossible to tell except by experiment to see what the soil needs, but do not manure in the hill, spread it on either broadcast or in the immediate vicinity of each hill. The best kind to plant is that which has small stover, with large ears and large kernels. It should be cut before the stalks are dry or there is a dry husk on the ear, as soon as the kernels begin to glaze. Then if properly stood up, the corn will ripen off all right and the stover be much better than if cut later. By following these directions and using machinery in every available place, corn can be raised in New England for less than 40 cents per bushel.

DAIRYING.

BENNINGTON INSTITUTE.

Wednesday Forenoon.—Meeting called to order by the chairman, when Mr. Pember took up the subject assigned him of "Dairying," and addressed the audience in his usual pleasant manner. Dairying is not made so much of a special industry in this part of the State as in some others, yet it is always a subject of much importance, and brings out an interesting discussion whenever brought up for consideration. At the conclusion of Mr. Pember's address, Mr. Davis led off in a discussion upon the subject under consideration. He thought that a farmer should always have a liking for his occupation, and if the manufacture of butter is a special industry the farm should be well adapted to the business in hand, being well supplied with good pastures and pure water. He advocates strongly good care as he is wont, as neglect will soon make itself felt in the dairy. He thought that farmers in this part of the State in so close proximity to market would do well to keep what is known as winter dairies. He alluded to the importance of making a superior article of butter, and securing regular customers if possible for it, as when this is done satisfactory prices will be realized, and if well liked it will be wanted regularly in the future.

With the vast immigration to this country, he is of opinion that good butter will not become a drug in our markets for the present. Thinks that farmers should aim for more than the general average of

butter, 125 pounds per cow, as this will hardly pay for the production. While he does not believe that better butter can be made from any modern system of milk setting than by the use of the small tin pans, with good conditions, yet he would advise more modern apparatus for the saving of labor. The remarks relating to the churning, working of butter, etc., have been given in substance before.

After the remarks of Mr. Davis, Mr. Pember answered some questions asked by gentlemen. He does not claim more cream or butter from deep setting than by other methods, with good conditions.

Mr. Irish thought that better butter could be made by deep setting than other methods.

The question of odors being discernable from the submerged system, Col. Potter thought that this could not be the case if the milk was pure and clean when drawn. Prefers stanchions for confining cows in a stable. Col. Potter advised keeping cows quiet and comfortable, and for this purpose did not consider the stanchion the best method for confining cows in a stable.

Mr. Rockwood was decidedly in favor of stanchions, but would card the cows regularly. Mr. Pember would not milk a cow up to very nearly the time of calving, as a period of rest should be allowed.

BRATTLEBORO INSTITUTE.

Question by J. C. Newton of Brattleboro: "Is butter injured by working in ice-water?" Mr. Goodwin of Hartland, member of the board, replied that this was a disputed question. Mr. White of Westminster thought if ice touches the butter it injures its color and flavor; and on this point nearly all the speakers seemed to agree. Too quick churning was also thought to injure the quality of the butter.

Senator Goodwin inquired for the best feed for butter. Mr. Pratt of Brattleboro said he had fed one quart of cotton-seed meal, with bran or middlings, and corn meal; does not feed cotton-seed meal at present, because some of his customers to whom he sells milk think it injures its flavor; prefers middlings to bran; when feeding bran would use a larger proportion of corn meal. Mr. I. B. Taft, having been called for, said he was one of the first in this county to use cotton-seed meal. He fed at first five or six quarts per day, and spoilt some of his cows. For this reason he stopped using it for a few years. He is now using it again, having learned how to feed it; finds bran the best to feed with it; feeds two or three quarts of cotton-seed meal with five or six quarts of bran; prefers bran, pound for pound, to middlings. Senator Goodwin had also spoilt cows by feeding too much cotton-seed meal, but thinks it is not injurious if fed in proper quantities, and it is cheaper than corn meal. He has but little faith in bran alone, but believes it good as a dilutent of more concentrated food. His cows have not had a foddering of hay this winter; he is feeding a mixture of cotton-seed meal with other meal feeds, straw and corn fodder. Mr. Applin of Putney feeds about a quart of cotton-seed meal with corn and oat meal and cut straw. Oil meal increases the yield of butter, and he would like to know what quantity can be fed with safety.

Some one stated that butter worked over immediately after salting would be certain to have white streaks that could never be worked out. Mr. Goodwin thought it was possible to work out the white streaks, but butter should not be worked immediately after salting, because the sharp crystals of salt cut the granules. Time should be given for the crystals to dissolve before working the butter. He likes the barrel churn, and thinks it makes better butter.

A discussion arose about the value of corn-cob meal. Mr. Goodwin, I. B. Taft, and several others, believed in corn-cob meal. The opinion of Prof. Collier, based on a chemical analysis, that there is a nutritive value in the cob, was quoted. Mr. Loren P. Smith of Trumansburgh, N. Y., said that in his section there were no mills for grinding the cobs with the corn; all the farmers there thought the cobs not worth the cost of grinding. Mr. Perry mixes one bushel of oats with a barrel of corn ears cracked and ground together, and adds to this an equal part of cotton-seed meal, and feeds two quarts of the mixture twice a day.

CHELSEA INSTITUTE.

Considerable discussion ensued concerning the grasses, seeding, etc., when the subject of butter making was started by ladies present and a very interesting time occupied in its consideration, lasting until a late hour. We have never before found so much interest on this subject manifested at any of our meetings by the ladies. Mrs. Hemenway inquired concerning white specks in butter; said that she was troubled with them in winter when having little milk and kept in small pans. Has found that putting a tablespoonful of soda in a churning of cream sufficient for twenty pounds of butter would in a great measure obviate this difficulty. Works butter once. Puts paraffine on the inside of the tubs to prevent any taste from the wood. Mrs. Charles Erskine of Williamstown keeps butter from June to September, and this is largely practiced by farmers in this region. The tubs are prepared by simply putting in ashes and hot water for an hour or two before packing the butter. The inside of the cover is coated with paraffine to prevent any taste from getting to the butter. Two cloths are put on top of the butter and covered with salt. Previous to selling, the outer one is removed, and a fresh sprinkling of salt added.

Mrs. Howe finds it a good way to line the inside of the tub with thin muslin after wetting with brine. This is easily done and works well.

Mrs. Webster would not wash butter, as she thinks the nice aroma is thereby not so easily retained.

One man spoke as having been troubled with white specks in butter with deep setting, which is something new. This more generally occurs when the milk is set in small pans. These specks are supposed to be dried cream, and one lady stated that butter, but of poor quality, had been made from them. It was thought three fourths of an ounce of salt to a pound of butter was sufficient, unless for long keeping.

ENOSBURGH INSTITUTE.

G. S. Fassett asked in relation to the average of butter and the relative value of cows. It cropped out that some farmers here did not make over one hundred pounds per cow, though they were loth to own it. Mr. Fassett believed the average one hundred twenty-five pounds.

A. L. Hall of Bakersfield thought the average too low, though it might be true this year; he believed it a bad year for pastures.

S. H. Dow said he made over two hundred twenty-five pounds to a cow; kept twenty-one cows and fed the best he could. His pastures are good, better than ever before. He always cuts up every bush and needless thing in his pastures. Breed, Jersey grades.

G. S. Fassett makes two hundred fifteen and one-half pounds per cow; keeps twenty cows; feeds corn and cobs and barley meal mixed, and now and then puts in shorts; feeds about two quarts of this mixture in winter; feeds less in summer, say, one pint of barley meal. Cows, Jerseys.

Mr. Pember spoke in the consideration of the dairy interest. The question being asked how many of the farmers present keep an account of the average yearly production of their dairies, a large number answered in the affirmative. Five stated that they had sold two hundred pounds or over per cow of their dairies, and fifteen that had exceeded one hundred fifty pounds per cow.

Solon Marsh of Fairfax, from a dairy of twenty-seven cows common stock, sold the past season an average of two hundred and five pounds. A. A. Moore of East Berkshire, from ten short horn cows sold an average of two hundred ten pounds.

W. H. McAllister from thirty-nine cows, Devons, averages nearly or quite two hundred pounds.

ESSEX INSTITUTE.

Dr. Lucius C. Butler addressed the audience on "Abortion in Cows." It appears that there is considerable trouble resulting from this disease to the dairies in this part of the State. The causes that produce abortion may result from accidents of some kind, which are very natural. Thinks there may be three causes: improper stable and ventilation, and the presence of filth or dead animals. Nothing of this kind should be allowed on the premises. If cows are fed largely on corn meal, this may have a tendency to inflammation and abortion. Perhaps cotton seed meal may also be injurious. Advise more care in ventilation as a matter of great importance as regards the health of the animals. There should be a proper temperature in stables, neither too cold nor too warm. Cleanliness was spoken of as a matter of necessity. Two farmers present out of four, feeding cotton seed, have had trouble from abortion.

Mr. Davis of Westminster, has fed largely of cotton seed meal, about two quarts a day to each cow, and recommended its use in proper quantities. Has no trouble from this disease.

Mr. Jackson of Milton, has fed cotton seed meal and with good results. He stated that a neighbor last fall had several cases, it was thought the result of feeding corn fodder on which there was smut, or ergot. Another farmer gave a similar experience, but is uncertain as to the cause. Has fed no cotton seed; is feeding bone meal, and he thinks with good effects.

Mr. Chapin of Essex, has had thirteen cows during fall and winter. Out of twelve heifers coming three-years-old, one-half aborioned. He spoke of another farmer who has had twenty-three cases.

Mr. Davis does not think corn fodder is the cause of the trouble. Dr. Butler was of a contrary opinion; that the smut or ergot on the corn was a cause of the difficulty. Mr. Davis believes in means of prevention as better than remedies of cure. He finds that four pounds of sulphur and one pound of saltpetre, mixed with one bushel of salt, to be good for the general health of cows; each a dessert spoon full per day.

Dr. Butler spoke favorably of this mixture as excellent for the purposes named.

M. W. Davis feeds four quarts a day to cows in summer, composed of corn, cotton seed meal and bran. Makes much account of good clover hay and well cured corn fodder.

FAIRFAX INSTITUTE.

In the afternoon Mr. Pember spoke on the dairy interest. In the discussion Mr. Bliss thought that oleomargarine comes in competition with the best grades of butter as well as the poorest, as most people do not suppose. The manufacturers and dealers in this imitation product are very sharp in their practice, and we must look out for them. He said the market quotations for butter are a delusion, not being trustworthy in character so far as city reports go. He stated that many men in Chicago send to Vermont for butter in order to get an unadulterated product, as they cannot obtain even their own Elgin creamery butter in that city. Mr. Bliss also stated that all imitation butters are not usually sold under their own name in Boston, and there is no price for it except for exportation. Several other gentlemen did not quite agree with this statement, and were of the opinion that oleomargarine can be found if desired. E. J. Parker of Georgia read a paper on the "Cream Gathering System," in which he is a pioneer in this part of the country,

GUILDHALL INSTITUTE.

Mr. Lane asked "To what extent feed will affect the quality of butter?" Mr. Grant answered that corn meal would not much increase the quantity of milk, but will improve the quality and the quantity of the butter. Middlings and shorts will increase the flow of milk and the quantity of butter, but it will not be of so good color or quality. Roots will increase the quantity of milk, but it will be at the expense of the quality of the butter. Cotton-seed will increase the amount of milk and butter. Thinks that an equal amount of corn

meal and wheat middlings will produce the best results in butter, quantity and quality considered. Meal made into a slop will increase somewhat its value, but this is too much work in a large dairy. A cow having two quarts of meal a day should consume as much hay as without the meal. A proportion of one quart of cotton-seed, two of corn meal and five of bran, he thinks would be valuable to feed. Nicely cured corn fodder with some meal will make very good butter, but would not like to feed straw for this purpose. Replied that his dairy, composed of young and mature cows, has not yet succeeded in making over 200 pounds each in a year. Keeps from fifteen to twenty cows, grade Jerseys. Gets forty cents per pound, net, for his butter at present. Mr. Goodwin stated that he is feeding six cows this winter on corn fodder and oat straw, with the addition of six pints of corn meal and one pound of cotton-seed, each, a day. Makes thirty pounds of good butter a week, and the cows are doing nicely. All are due to calve in March or April next.

HIGHGATE INSTITUTE.

An instructive lecture on "Milk" was given by Dr. Cutting. He spoke of the necessity of careful selection of cows for the dairy. Farmers would be surprised to see the great difference in the structure of cream, as may be learned by the aid of a microscope. Different breeds should not be mixed in a dairy if the best results are to be obtained, as from the difference in the structure of the milk, the cream will not rise equally and some will pass off in the buttermilk and be lost. The taste is capable of being educated to a high degree and no where is this more evident than in the taste for butter. As the standard of quality for this product is continually being advanced, the farmer must be on the alert in order to keep pace with this progress. Garget was attributed to indigestion and is not a disease of itself, but rather the result of a cause. Look out for the general health of the cow. Feed salt regularly and occasionally a little saltpetre, but this not often, for it excites unnaturally the secretions of the kidneys, and this is injurious. Does not believe in "horn-ail," so called, as a disease in itself. A considerable discussion on "horn-ail" was engaged in, some thinking there is such a disease, but this as before stated is one of the results of a specific disease, or catarrh in the head. Bloody milk may be the result of a rupture of the small veins in the udder, or outward injury. Sometimes the rupture of the veins can never be cured and the animal so afflicted should be disposed of.

LUNENBURGH INSTITUTE.

S. T. Hale asked of F. C. Grant if he ever colored his butter. He said he did in winter.

Question. What time must elapse between washing, salting and working?

Answer. Six hours. I never touch with hands. I use one and one-half ounce to the pound, salting always by weight. I think one-half ounce remains. My cows make the most butter per quart when they give the least milk.

LUDLOW INSTITUTE.

After calling the meeting to order the chairman introduced Mr. Pember, who spoke upon "The Dairy." After this address, one farmer inquired as to the best method for raising cream. Mr. Pember replied that he was not able to name the best method in all cases, he preferred what is known as deep setting and moderately cool, but not cold, as is sometimes practiced. Let cream taken from the milk sweet be kept for a little time before churning to ripen. Does not believe that as much butter can be obtained from sweet cream as when slightly sour, and it will not keep as long. Milk should not be set where it can be contaminated by any unsavory odors. A farmer present did not believe in this theory, which appeared rather strange. Butter for long keeping must be packed in tight, clean tubs. Packages should be soaked in strong brine to remove the taste of the wood. A farmer does this by putting in wheat bran with hot water and cover for a time, then soak with brine. The chairman cleanses tubs with wheat bran and hot water.

A butter package was on exhibition, which was simply a tin tub similar to a sap bucket, which fits in a cheap wooden case, leaving an air space between the tin and the wood. The cover fits in so nice that the air is excluded. It is claimed that butter will keep well in this package. The tin package can be easily removed from the case or "jacket" on arriving at market. A package for fifty pounds will cost fifty cents at wholesale, somewhat more than wooden tubs. These can be returned if desired.

Mr. Goodwin spoke of dairymen in Washington county coating the interior of butter tubs with paraffine, which will exclude the air and prevent the butter from tasting of the wood. Poor butter will deteriorate much more quickly than good butter. Two farmers present stated their average yield to be 200 pounds per cow. It was thought that the average yield of butter in this section will range from 125 to 150 pounds per cow. Mr. Sawyer, of Plymouth, stated that he can make a living from a yield of 100 pounds of butter per cow, at the regular price, which was an astonishing assertion to many present. The gentleman must be much more favorably situated than most farmers.

Mr. Sawyer feeds no meal to his cows, and feeds largely on poor hay. Mr. Chapman feeds from twelve to fifteen dollars worth of grain to his cows, and makes 200 pounds of butter per cow. Without the grain thinks he would make not more than 125 pounds per cow. Is satisfied that feeding grain pays him well. At the same time the productiveness of his farm has largely increased. Dairy composed of grade Jerseys.

MIDDLEBURY INSTITUTE.

A. J. Hollister of North Montpelier said he thought the goal too high in fixing 300 pounds per cow as the point to be attained by the farmers before it would really pay. He was making 200 pounds, and thought that amount without meal was better than 300 pounds when a

large proportion of the profits had gone in meal. Being asked about ensilage, he spoke highly of it; said he was now keeping just double the stock on the same number of acres that he did two years ago, and bought no more feed for them than he did for half the number before. He uses ensilage, having two silos already, and is to put in a third in the spring.

MONTGOMERY INSTITUTE.

Mr. Pember inquired as to the methods of milk setting in Montgomery. It was answered the large flat pan is most to be found, both dry and prepared for cooling with water.

MANCHESTER INSTITUTE.

Dr. H. A. Cutting then gave an address upon "Milk: Its peculiarities and uses."

He represented it as the perfect food of childhood and young animals. That it was in the stomach of the child just fitted for digestion, while starch and many other substances could not be digested until after the teeth appeared, when other changes which took place at the same time supplied gastric juices.

Milk contains:

Nitrogenous matter	4 1-10	parts.
Fats	3 9-10	"
Lactine	5 3-4	"
Water	86 1-4	"
	100	

Specific gravity .1030, but this can be changed by various tricks of the producer, so that it is never a sure guide to buy by.

Jersey milk, as it contains more and better cream, averages .1027. The milk of the cow contains:

Of the butter product	3.70
" woman	3.34
" goat	4.00
" sheep	6.00
" mare	.20

The amount of water is as follows:

Cow	86	parts.
Woman	89	"
Goats	85	"
Sheep	82	"
Mares	88	"

Thus every one can see that in feeding children or animals as a rule it is not necessary to water it or skim except for the colt, where the cream is almost entirely wanting, and must be removed as his stomach will not tolerate it. It should form a curd in all young immediately after being taken, and if it does not do so it indicates ill health. If on the other hand a child should vomit a hard curd, a little alkali or lime water might be added to the milk with advantage.

Milk cannot be skimmed close enough but what about one third of the animal fat will remain. So skim milk as a rule will contain:

Water	88	parts.
Cream	1.20	"
Nutrient matter about	7.60	"

The way in which farmers can produce the best milk was then treated. They should be fed sweet, nutritious food, and kept in well ventiliated stables, never allowed to drink filthy or very cold water, or to be fed in an irregular, hap-hazard manner, but every care should be taken to keep the cows in good condition and the best of health.

MIDDLEBURY INSTITUTE.

A. D. Evarts of Waltham, gave a lecture entitled "A Review of Modern Dairy Methods." He began with an enumeration of the methods most approved by successful dairymen. The importance of judiciously selecting cows was dwelt upon at some length. There is a great difference between a good cow and a poor one. A cow is worth what she can produce above the cost of keeping; this is the real standard of value, and according to it cows should be bought and sold. He believes in quality rather than quantity of milk, and thinks corn meal, early cut hay, clover and orchard grass are excellent foods for dairy animals. He would have some of the cows come in in the fall. The sooner milk can be made into butter the better. His method is to raise cream by cold setting, warm to seventy or eighty degrees, then cool to sixty degrees and churn the next day. In his opinion butter should be worked but once; and cream or butter is not improved by coming in contact with ice.

The reading of the paper was followed by a discussion, led by Mr. Pember, and participated in by J. E. Crane of Middlebury, F. D. Douglass and E. B. Douglass of Whiting, and others. It was generally agreed that butter ought not to be worked more than once. It was also said that first-class butter could not be sold in the local markets for what it is worth. The finding of special customers for such an article was recommended.

ORWELL INSTITUTE.

E. R. Pember remarked that milk may be rendered impure and sometimes poisonous by poor feed or impure water. It is well understood among physicians that a great many cases of disease and death even, are caused by using impure milk.

F. D. Douglass followed with some pertinent remarks on "What we know and what we do" as applied to the dairy interest. We all know that light is necessary to health and life, and keep our cows in stables from which the light is excluded. We would not build a fire on a cold day and open the doors expecting to keep warm, but we waste more expensive fuel, in fact, on our cattle by keeping them where they shiver with the cold; does not believe in bad luck. It is

the result of negligence in general. Many things are called the dispensations of Providence, that are really the result of our own ignorance. We all know that air is the most fickle element in nature as to temperature, and we used it for years to temper the milk when water will accomplish the same end so much easier and quicker, and is so much easier controlled. Learn to trace effect back to cause, and if farmers will only use what knowledge they have, they will accomplish far more than most of them now do.

Mr. J. J. Branch of Orwell, gave a paper on "Dairying," touching principally on the selection of cows and butter making, giving something of his own experience in these matters. In selecting cows for a dairy would prefer to buy a whole dairy of heifers, rather than buy one or two in a place; would pay no more for a cow than that cow would make in one season; keep them comfortable and clean; would feed the best of hay; if that could not be had make up the deficiency by feeding grain, and feed each cow according to her needs. Milk evenly on both sides of the udder; keep the cows quiet while milking. Use only tin pails in milking, as these can be kept perfectly clean. If proper care is used in milking, but little necessity exists for straining, but strains usually through cloth; would not use the small tin pan, as their use involves too much labor; is of the opinion that the shallow setting produces more cream than deep setting, but never used the deep setting or made any experiments to ascertain the difference, if any; lets the milk set till it becomes slightly acid before skimming; keeps the cream thoroughly mixed in the cream pail when new cream is added; finds that a temperature of fifty-eight to sixty degrees the best for churning in summer, and sixty-two to sixty-four degrees in winter; would never use a churn having floats inside, as there is always a loss attending their use; would color butter if it needed it, but not color too high; works his butter immediately on taking it from the churn; does not think he injures the grain of the butter by so doing, and packs at once; packs in spruce tubs, soaks them in some milk to remove the wood taste. The cream that rises first will make a better grade of butter than that which rises later. The competition of western butter is so great that we must avail ourselves of all the improved methods and appliances for the dairy in order to sustain ourselves.

Mr. E. D. Douglass did not think that the best western creameries was any better than our best Vermont butter; stated facts to show this. Mr. F. D. Douglass explained the process of "ripening" in cream. This must be done by exposure to the air; prefers to have this process commenced before the cream is removed from the milk; found by experiment that the cream can be best obtained, either at a temperature of from fifty-eight to sixty-three degrees, or very cold at forty degrees or below.

PUTNEY MEETING.

The chairman called the meeting to order at ten o'clock. A few questions were presented and answered. "Does heating milk drive off the odors?"

Mr. Pember thought it might unless it contained some highly injurious odors. Heat to 140 degrees.

"Is there danger of Vermont dairying being overdone?"

The chairman thought that good dairying would not.

"Which would he recommend for a young man, all things being equal, sheep husbandry or dairying?"

Mr. Davis thought that both were about equally balanced, yet was rather inclined to sheep husbandry, especially for our hill farms. Mr. Lane would advise the young man to follow his own inclination in the matter. Mr. Courser spoke in favor of the Spanish merinos. Is satisfied that sheep pay him better than cows. Can take care of 200 sheep easier than two cows, aside from lambing time, which lasts about a month. Mr. Lane would have sheep with a recorded pedigree, as that is of the greatest importance in selling for breeding purposes.

"How can a good herd of cows be improved?"

Mr. Pember thought that if butter is the object, a cross with a good Jersey strain would be profitable.

"Which is the best, cotton seed or linseed meal, and how much cotton seed can be fed to a cow?"

Mr. Davis said that two quarts can be fed with safety when mixed with some kind of provender. Mr. Lane stated that the new-process linseed meal is not so good as the old kind. Cotton seed also varies in quality, the finer ground and lighter colored usually being the best.

A gentlemen asked what were white specks in cream or butter?

Mr. Pember answered that they were only dried cream, and usually are found when milk is set in small pans. Does not find these in the cream with milk set in deep pails.

Mr. Towle stated that they are not found where the large pans are used.

A farmer inquired if milk in cold setting will produce butter of as good color as in large pans or other methods.

Mr. Williams being called upon said that from his experience, if he wished the best quality of butter possible, without regard to cost, he would have a suitable room and set the milk in the small tin pans, but this would hardly pay. Thinks the best colored butter would be obtained in this way. Is of opinion that one reason why cows go dry so long in winter is that they are milked so irregularly. This defect should be remedied by more attention to the matter.

Mr. Reuben Miller practices the submerging system, letting the milk stand twelve hours before skimming. He can make a much better butter and more uniform in quality with the submerged system than with the small tin pans.

PASSUMPSIC INSTITUTE.

Mr. Towle spoke of the importance of using the cleanest and best brands of salt to be obtained and the best packages, even if they do cost more, as it will be the cheapest in the end.

Judge Parks being called upon, made some remarks on the subject

under consideration. He spoke of the importance of first selecting cows. Does not intend to keep one that will not give a yield of 300 pounds per cow annually. Does not allow a cow to shrink in summer. Cows, high grade Jerseys, with a good pasture, nothing more is needed. When the grass begins to fail give shorts until sweet corn is fit to feed, and this will last until November. Feeds early, cut hay in winter along with oats, shorts, and cotton seed meal. Proportions, one quarter cotton seed, one quarter oats, and the balance shorts or middlings, in bulk. Give from four to five quarts per day at noon to each cow, according to age. Waters twice daily. Likes the cotton seed very much, but it should be fed carefully. Uses the Bureau system of milk setting and likes it. Has cows that give milk continuously. Would prefer to have them go dry a short time, however.

Rev. J. H. Winslow spoke of a successful dairyman in Essex County who intends to have one-half ounce of salt to a pound of butter when it goes to market. Some prefer more.

Mr. Pember does not favor salting, working and packing butter at once after churning. Thinks this practice requires too much working, and therefore injures the grain.

Judge Parks mixes coloring matter, when it is needed, with sugar, using only a small quantity for this purpose as a good practice.

Mr. Goodwin was of the opinion that strong soft soap would injure the utensils used in churning, etc., the potash acting unfavorable on the wood, imparting bad odors.

The chairman stated that for the past two years most of his butter has been made directly into balls from the churn. Likes the practice well. Soft butter cannot be managed in this way with good results. Salts to suit customers.

Mr. Foster spoke of the importance of having good pastures for successful dairying. Artificial food will not produce results equal to good pasture grasses.

Mr. Harvey made from ten cows last year 225 pounds each. Fed grain in spring. Said that farmers are too extravagant, which is a great drawback in their business. Farmers should live within their means.

Mr. Foster believes in feeding meal; it helps to improve the farm. A considerable number of farmers present make an average of 200 pounds per cow annually. The discussion lasted until quite late and was unusually interesting.

WELLS INSTITUTE.

Dr. H. A. Cutting made some remarks upon milk, urging all to look out for taints and smells, as they would affect butter. He remarked that smoking while milking or about the milk room would flavor the butter. He also spoke of the want of ventilation in close barns as detrimental to the butter interest.

Referred to various cases, among which was Charles H. Cole of Lunenburgh, that built a superior barn, but for lack of ventilation his milk was injured. He increased that ventilation and all was right. A gentleman in Orleans County with a new barn was reduced eight or

ten cents per pound on the price of his butter, which was only restored by proper ventilation of his stables. Barn cellars should always be ventilated. Capt. Clark of Montpelier, lost some young cattle for want thereof, and in several cases loss or damage has resulted from this neglect. In one instance the hay in the barn above the cellar was so contaminated that it could not be fed to milch cows without injury to the butter product.

WINDSOR INSTITUTE.

Mr. Gates stated when the famous Jersey Queen was mentioned, that he owned her when she produced her first calf, and that then she appeared to be so ordinary that he concluded to sell her. This goes in confirmation of the opinion that poor heifers sometimes make excellent cows, hence it is not always safe to judge of the character or value of a heifer from the first one or two years of giving milk.

Mr. Walker spoke of the case with which milk can be contaminated with various substances, hence great care should be exercised in keeping them out of the way. He inquired in relation to silos.

Mr. Pember finds that grade Holsteins make a very good cow. They are very quiet and good feeling and excel in quantity of milk, and is thought to be equal in richness to ordinary native cows. They are good for the production of cheese.

Mr. Davis stated that he did not practice keeping the milk in the stable while milking.

Mr. Walker urged good treatment of cows, and Mr. Gates would not have a man using tobacco in the stable.

Mr. Goodwin spoke of the necessity of keeping the vessels from any contamination.

Mr. Davis stated that the feeding of witch grass is injurious in its effects on the milk.

WHITE RIVER JUNCTION INSTITUTE.

In answer to a question, Mr. Davis thought that sixty-two degrees would be the proper temperature of cream for churning in winter. The chairman would prefer sixty-five to fifty-eight degrees, else the process would be too long. Like to have butter come in a granular form, as in that condition the buttermilk can be more readily separated. Salt to suit customers, and endeavor in every way to meet the demands of the market.

After the remarks of Mr. Davis, E. R. Towle spoke of the necessity of getting good packages for butter. This has more to do with the sale of the contents than most may suppose. James R. Walker, of Springfield, keeps a small herd of Jerseys, and makes butter largely in winter and likes the practice. Feeds corn largely for grain along with hay, corn fodder and straw. Packs butter in five pound boxes and markets often. With winter dairying the cows will go dry for a time during the hot weather in summer and be fresh in fall. The practice is quite largely followed in this part of the state. The butter commands a higher price in winter than in summer.

Orville Lawrence, of Waterford, followed in some interesting remarks, of which he gave the valuable experience in a young farmer, who made $100 each from a dairy of 30 cows.

WASHINGTON INSTITUTE.

Some of the butter in the West is quoted as high and sometimes higher than Vermont butter. In view of this it behooves the dairymen of Vermont to be up and doing, if they wish to keep in line with these new competitors. There has been great progress in the dairy interest in Vermont, as no one can doubt when the quantity of butter produced and the quality is noted; but the limit in these directions has not been reached, and now that the West is such a strong competitor, it should be made a study how to make butter which shall bring the best price. In order to do that we must make the best article in the market, and to do this the dairymen must begin right. He must have a herd of cows from which all the poor animals have been weeded out, and those retained must be treated with the utmost care, and fed with scrupulous regularity on such food as will make the flow of milk large, and keep up the standard of its butter making quality at the same time. There is no particular breed of cows that can be recommended for all places; the soil and location should be considered in selecting cows, but a thoroughbred herd is not indispensible, as good butter can be made from any cows if they have proper care, but not so great a quantity from some as from others. He was urgent that the dairymen should use care in feeding, and in answer to a query, said he thought it better for the cow to keep up the regular and full flow of milk all the time when feed was low, as it tended to increase the quantity and quality when there was good forage. The subject of warming the water drank by milch cows was talked up quite extensively, and the experience of all who had tried it was strongly in favor of the practice as tending to save feed.

DISEASES OF ANIMALS.

PASSUMPSIC INSTITUTE.

It was remarked that lice usually affected animals in poor health, and then spread to others in the herd. Mr. William Lindsley sprinkles sulphur upon the skin. D. W. Storrs of Hardwick, uses salt the same. Dr. Cutting remarked that road dust, coal dust, snuff or any fine harmless powder is effective.

WALLINGFORD INSTITUTE.

Mr. Davis spoke of some of the diseases to which cows are subject, as milk fever, etc., with some hints as to treatment. As a preventative feeds his cows a mixture of one bushel of salt, four pounds sulphur and one pound saltpetre. Give a dessert spoonful to each cow daily. The chairman gives the mixture mentioned by Mr. Davis

twice a week only. Farmers here have considerable trouble with the foot rot in cows. Considers sulphur a good preventive for this disease, which he thinks contagious.

It was generally conceded by the farmers present that it was not advisable to remove an ailing animal from a warm stable to one that is cold, but the endeavor should be to keep the temperature as equal as possible.

REMARKS.

Your Secretary has said much about the usual habits of farmers in giving too much medicine to animals. Dr. Kendall of Enosburgh has published a book on the horse, where he gives a reasonable dose table. As I was consulted in its preparation, I take the liberty of giving it to you as well adapted to the horse and cow, and is as follows:

DOSES FOR THE HORSE OR COW.

NAME OF DRUG.	ACTION AND USE.	DOSE.	ANTIDOTE.
Aloes.	Laxative and Tonic	½ to 1 oz.	
Alum.	Astringent.	2 to 3 drs.	
Anise Seed.	Aromatic and Stomachic.	½ to 2 ozs.	
Aqua Ammonia.	Stimulant and Antacid.	1 to 4 drs.	Vinegar.
Arsenic.	Alterative and Tonic. Used for Paralysis, Mange, etc.	1 to 5 grs.	Magnesia and oil.
Assafœtida.	Anti-spasmodic, Coughs, etc.	1 to 3 drs.	
Bicarbonate of Potash.	Diuretic and Antacid. Good for Rheumatism	3 to 5 drs.	Vinegar and raw Linseed Oil.
Bismuth.	For Chronic Diarrhœa, etc.	½ to 1 oz.	
Black Antimony.	Promotes the Secretions.	¼ to ½ dr.	Infus'n of oak bark. Give also lins'd oil.
Blue Vitriol.	Astringent and Tonic.	½ to 1 dr.	Eggs, Milk, etc.
Calomel	Cathartic.	10 to 40 grs.	Eggs and Milk.
Camphor.	Anti-spasmodic.	½ to 1 dr.	
Cantharides.	Diuretic and Stimulant.	3 to 6 grs.	
Carbolic Acid.	Externally and Disinfectant.		Eggs; soap; gruel.
Castor Oil.	Cathartic.	½ to 1 pt.	
Cayenne.	Stimulant and Carminative.	5 to 25 grs.	
Chlorate of Potash.	Diuretic. Given for Bloating, etc.	½ to 2 drs.	
Copperas.	Tonic and Astringent.	½ to 1½ drs.	
Croton Oil.	Powerful Purgative.	10 to 15 drops.	Opium.
Digitalis leaf.	Sedative and Diuretic.	10 to 20 grs.	Stimulate.
Epsom Salts.	Cathartic and Febrifuge.	2 to 8 ozs.	
Ether.	Anti-spasmodic.	½ to 2 ozs.	
Fowler's Solut'n.	Used for Skin Diseases. See ARSENIC, a preparation of.	1 to 4 drs.	Hydrated Peroxide of Iron.
Gentian Root.	Tonic.	1 to 2 drs.	
Ginger.	Tonic, Stimulant, and Stomachic. Used for Flatulent Colic, Dyspepsia, etc.	2 to 5 drs.	
Glauber's Salts.	Cathartic.	6 to 12 ozs.	
Iodide of Potassium.	Diuretic and Alterative. Used for Rheumatism, Dropsy, Enlarged Glands, etc.	½ to 1½ drs.	Give freely, starch or flour, with water largely.
Linseed Oil Raw	Cathartic and Nutritive.	1 to 2 pts.	
Magnesia.	For colts as an Antacid and Laxative.	¼ to 1 oz.	
Mercurial Ointment.	Used for Mange, Itch, Lice, and other Parasites.		Whites of eggs with milk given freely.
Nux Vomica.	Nervous stimulant. Used for Paralysis.	15 to 25 grs.	Saleratus, followed quickly by copperas, both dissolved in water.
Opium.	Anodyne and Anti-spasmodic. Given in Colic, Inflammation of Bowels, Diarrhœa, etc.	¼ to 1 dr.	Belladona, str'g coffee, brandy, and ammonia. Dash cold water on, and keep the horse moving.
Prepared Chalk.	Antacid.	½ to 1 oz.	
Quinine.	Tonic. Given during Convalesc'e.	15 to 50 grs.	
Saltpetre.	Diuretic and Febrifuge.	1 to 3 drs.	Linseed oil largely raw.

NAME OF DRUG.	ACTION AND USE.	DOSE.	ANTIDOTE.
Soda Bicarb.	Similar to Bicarb. Potash.	3 to 8 drs.	
Soda Sulphite.	Antiseptic and Alterative. Used for Blood Diseases.	½ to 1 oz.	
Solution of Lime.	Antacid, used as an Antidote to poisoning by Acids.	4 to 6 ozs.	
Spirits of Chloroform.	Anodyne and Anti-spasmodic.	1 to 2 ozs.	
Strychnia.	Tonic and Stimulant. Used for Paralysis.	½ to 1 gr.	Tobacco.
Sulphur.	Alterative and Laxative. Used for Skin Dise's & Rheumat'm.	½ to 2 ozs.	
Sweet Spirits of Nitre.	Diuretic and Diaphoretic.	½ to 1½ oz.	
Tannic Acid.	Astringen .	20 to 40 grs.	
Tartar Emetic.	Sedative and Alterative.	⅛ to ½ dr.	Tannic Acid.
Tincture of Aconite Root.	Sedative. Used for Lung Fev'r, etc.	15 to 35 drops.	Give small doses of Nux Vomica, and stimulants largely, and keep mov'g.
Tinct'e of Cantharides.	Stimulant and Tonic.	1 to 2 ozs.	
Tincture Ergot.	Parturient.	1 to 2 ozs.	
Tincture Iodine.	Used Externally.		
Tincture Iron.	Tonic and Astringent. Used for Typhoid Diseases.	½ to 1 oz.	
Tr. Nux Vomica.	Tonic. Stimulant in Paralysis and Dyspepsia.	2 to 4 drs.	See NUX VOMICA.
Tincture Opium.	Anodyne and Anti-spasmodic.	1 to 2 ozs.	See OPIUM.
White Vitriol.	Astringent. Used for Cuts, Wounds, & Sores, in Solut'n.	5 to 15 grs.	Milk, eggs, & flour.

For a colt one month old, give one twenty-fourth of the full dose for an adult horse as given above; three months old, one-twelfth; six months old, one-sixth; one year old, one-third; two years old, one-half; three years old, three-fourths; and for calves and young cattle, same. Oxen may be given from one-eighth to one-quarter in addition.

ENSILAGE.

CABOT INSTITUTE.

Mr. Jason Cole of Danville, built a silo in his bay, and saved $300 in hay by so doing. Built of framed timber, spiked to the timber of the barn. Opened it December 3d; fed twenty-seven cattle. Cows look well, feel well. He fed them grain as he did those fed on hay, with one quart of meal, one quart of cotton-seed meal, and one of bran, mixed, twice a day. His ensilage was made from Sanford and Bailey corn. Put in about fifty tons. Size of silo was twenty-five feet deep, and fifteen by seventeen feet inside.

L. C. Fisher's silo built in bay of barn, cemented at bottom and side. First put in about twelve tons of clover rowen, which he says began to heat right away. He next put in two acres of Bailey corn. Next put in quantity of common corn with the greater part of the ears on the corn. When he come to feed, the Yankee corn gave a great deal better satisfaction than the Bailey corn. He was in favor of silos, and recommended them to be built with round corners.

Mr. Pitkin of Marshfield, gave his experience with silos. Said that these should be located so as to be convenient to fill and feed from. His silo is in one corner of his barn, is of stone, although wooden ones may be built, but does not think they will be durable. His silo is 13x20x10 feet. Would have them long, narrow and deep. Would not expose much surface to the atmosphere at a time. To be profitable fifteen tons of corn for ensilage should be raised to the

acre. This will require considerable fertilizing material. With large kinds of corn it will take from two to three tons to be equal to one of hay. Raised common field corn, and when the ears were glazed picked off the best, and then cut the remainder into ensilage. Likes the Sandford corn for this purpose. Would feed twice a day with ensilage and once with hay. Can make more and better butter with ensilage and meal than with hay and meal. With the system he is practicing more stock can be kept and the farm improved. He has a herd of twenty-four grade Jersey cows, from which a product of 300 pounds of butter on an average is sold annually.

ENOSBURGH FALLS INSTITUTE.

J. G. Emery, of Sheldon, read a paper on "Silos and Ensilage." He is one of the first to adopt this system in the northern part of Franklin county. Is of the opinion that ensilage, such as he makes from Sanford corn, is the best feed for butter that he has yet used for the purpose. Is worth nearly twice as much as hay for the production of milk in winter. Would have the corn in the milk when cut for ensilage, and when in this condition little or no grain is needed. Raises corn with only a barrel of superphosphate to the acre with good results. Can winter two cows on the product of one acre, which is certainly low enough. For winter dairying ensilage will be a great aid. His silo is built very cheaply of wood in his barn, costing $15 for one of forty tons capacity, but would prefer to build in a more enduring form. Finds that two tons of his ensilage is equal to one ton of hay, and produce twice as good results in the production of milk in winter. Does not feed grain with the ensilage. Has made 8 3-4 pounds per week of butter from one cow and 10 1-2 pounds from another. The ensilage does not heat to any extent. Would use cement on the bottom of the silo, but would not build in the ground. Have the silo as near the stable as possible. There is no waste by freezing where continuous feeding is practiced. Thinks it would be better to feed some hay in connection with the ensilage. The quality of butter made from ensilage is superior to that produced from hay and grain.

Harvey Olmstead was skeptical about ensilage; could not believe the stories that are told concerning it.

Mr. Emery thinks that the Sanford corn is much better than the large western or southern kinds. If well packed down when filling the silo several days may be occupied in the work. The ensilage is a trifle acid, but not enough so to do any harm.

MIDDLEBURY INSTITUTE.

Dr. Cutting said a question had been handed to him. His opinion of the value of ensilage was asked. In reply he read a letter on the subject, written by Frederick Conant of Middlesex County, Mass.

He writes as follows:

"I have filled a silo twice with corn and rowen, but do not propose to fill it again. The rowen I consider good, but the corn I consider

not as good as meadow hay, and I stand ready to risk any money that cattle fed on corn ensilage alone will grow poor and dry up on it. I fed it to dry cows with two quarts of bran one month, and then gave them five qnarts. They lost flesh, never looked plump, and went without drinking for days at a time. Folks come to my barn now (I am a cattle trader) and make the remark that my cattle look better than they used to, and I know it without being told. I built a double silo, costing me about $700 in time and money. I consider it about so much money thrown away. Talk about its making a farm richer! It will make the land poorer, for the reason that it makes poor manure, and if one hundred tons of ensilage are raised it takes all of that manure and more to raise the next one hundred tons. Farmers in this town have not averaged fifteen tons of ensilage corn per acre. It takes the best of land and the highest of manuring to raise twenty-five tons. Those who don't believe it had better try it. A small silo that would give the cattle one feed a day would be good—just about as good as the same amount of apple pomace, and I think no better, if the pomace is sweet. It is all heavy, hard work putting the corn in the silo and getting it out, costing me nearly $1.50 per ton for the getting in. I have sold cows the past two winters that gave after leaving me from one to four quarts more milk, which I suppose is a credit to me, but rather expensive. One cattle trader told me last winter that I had lost more than $200 on the sale of my cattle by feeding ensilage, as my cattle never were full and plump. I think there are but four silos in this town—two of them are empty, never again to be filled. It is my candid opinion that in less than 15 years silos in this country will be no more. There are a few men who have made money by getting the farmers to build and selling them cutters for $75 to $100 apiece, and corn seed for $3 to $4 per bushel. They have made their last dollar out of me, and I am still able to pay my debts, but feel mighty sore to be fooled so. I have said nothing about the manner of building silos, for if a man is silly enough to build, let him do it as he thinks best."

Dr. Cutting said this was an extreme view of the case. His own opinion was that ensilage could in some cases be used to advantage in connection with other fodder. Alone it would not maintain stock in prime condition for a great while. Whether it could profitably be raised depended upon the soil. Where the soil is light and the hay crop small, corn may be grown and ensilaged to take the place of hay, and he believes to great advantage to the farmer thus situated.

As he could raise from three to four tons of hay upon an acre, and his land was too wet for corn, he was satisfied he could raise grass best, as the green crop would weigh much more than the green crop of corn. Never saw grass ensilaged in a perfect manner, and shall dry his and not pnt in a silo. Yet where corn would grow and grass not, he should put in a silo.

MANCHESTER INSTITUTE.

Mr. Graves, of Sunderland, gave his experience with ensilage. Built his silo in the basement of barn, of stone and concrete. Size

12x24x10. Raised twenty-five tons of corn from 1 1-2 acres. Fed cows part of the time twice a day and part once a day. This would be equal to keeping four cows a year. Save to quarts of cotton seed meal and middlings. The cows increased in yield of milk when put on the ensilage, and the quality of the butter good. Would let the corn ear and be in the milk before cutting into ensilage. Likes the system well, and intends to build another silo the coming year.

Thinks the amount of crops can be greatly increased. Would also raise two crops in a year on the same land, one of winter rye and one of corn, as a good practice.

Mr. Bowen, of Manchester, is interested in silos and ensilage. Built a silo of stone and cement, conveniently located. Size 12x20x15 feet. Filled with corn and opened the first of November, and the cows did remarkably well, holding out unusually long in milk. Fed twice a day with ensilage and once with dry cornstalks. The cows did not eat stalks well until they were cut up and mixed with the ensilage, when all was eaten up clean. Give this mixture twice a day and hay once a day. Since January has fed two quarts a day of corn and cob meal and oats. The cows are looking well. Is well pleased with the result, and considers the system of great value to farmers.

Mr. Graves said that a cubic foot would make about two bushels when loosened up. Cows require but little water when fed on ensilage. He makes butter through the winter, and the color and quality is superior, although not feeding as much grain as formerly with dry fodder.

PASSUMPSIC INSTITUTE.

Question by Dr. Drew of Danville: What do you think about silos and ensilage?

Mr. Goodwin—I am not a practical feeder of ensilage; it may become a practical thing. I have always said "go slow," and I am not satisfied yet as to its utility. A Mr. Bagley of Windsor has sold his farm with silo; was not satisfied I think with ensilage. Mr. Dunbar of Hartland, I think, is not satisfied; it looks like a place of desolation and despair. Sheep look bad. Mr. Chase is not satisfied with it. *I* think butter may be injured and milk, as ensilage is now preserved. If it could be kept from acidity might be expedient to feed.

Mr. R. P. Harvey read from the New York *Tribune* a statement against ensilage. Dr. Drew has fed ensilage this winter in connection with corn meal and cotton seed and is very much pleased, saving a large amount of other fodder and gets a much larger flow of milk. Would not do without a silo under any consideration.

WHITE RIVER JUNCTION INSTITUTE.

Mr. Ballard invited the board to visit his silo, which they did and report as follows:

His farm contains 700 acres, and the buildings on it are insured for $22,000.

He put in 500 tons of ensilage and is wintering seventy-five head of cows and heifers, which he feeds entirely with ensilage and meal.

The meal feed is one-third cotton seed and two-thirds corn and cob meal. He feeds to cows in milk three quarts a day in two feeds—one and one-half quarts each. Several cows are fed entirely on ensilage without meal; are not in milk but are fat enough for beef.

His cow stable is in the second story, is 30 feet wide and 138 feet long; he ties on both sides and every stall is ventilated in front of the cattle. He feeds from the third story, and every cow has her own separate feed; each cow has two feeds of ensilage of thirty-seven pounds each per day, with the meal feed at the same time.

His stable, if not the very best in arrangement, is one of the best on the continent, and his cattle are looking finely though they have not had a lock of hay this winter. He has sold nineteen head of Jerseys the past season for over $3000—two of which were sold for $300 each. His best Jersey bull is fed entirely on ensilage and is as sleek and handsome as on the best green feed of a pasture.

Henry Dunbar of Hartland, has found ensilage a good thing to fatten cattle. Gives twelve quarts of cob and corn meal in connection with ensilage, to each. When he commenced feeding the cattle they weighed Nov. 1, 3450 pounds; Jan. 1, they weighed 3840 pounds.

WASHINGTON INSTITUTE.

Gen. Thomas recommended the feeding of cotton seed meal and ensilage. Does not believe either damages the butter.

FEEDING.

ALBURGH INSTITUTE.

Loren P. Smith of Trumansburgh, N. Y., took up the subject of the "Winter feeding of stock." He first spoke of having seen on the way to the place of meeting stock out-of-doors in the storm, and stated that much more value in food is required for the keeping of stock not fully protected from the weather, than when properly housed. The same would also apply to cold and uncomfortable barns. He is careful in finding as near as possible what each animal—cows, for instance—needs, so that it may have enough and eat it up clean. Believes in a variety of food, but would not often make changes. Care should be exercised in not giving those kinds of feed that impart an unpleasant flavor to the milk or butter, or especially in very large quantities. In summer when feeding clover gave no grain, but did with fodder corn. Uses a little salt dissolved in water and sprinkled with the meal on the cut fodder.

Mr. Goodwin followed in some remarks. His experience with wheat bran alone has not been satisfactory, as it reduces the quantity of butter in a given amount of milk. Would mix linseed or cotton seed meal with the bran.

Mr. Williams of Walpole, N. H., a successful dairyman, does not let his stables get reduced below 45°, and the flow of milk is very

uniform. Mr. Marvin thought there might be considerable difference in the quality of bran; that from our own mills should be more valuable than that obtained now from the West. Mr. Goodwin finds that oats increase the amount of milk, but the butter is white, and they are too expensive to feed, compared with other kinds of grain and meal. Mr. Smith does not think it will pay to grind corn with the cob, yet it is practiced by many farmers. Mr. Goodwin would grind the cobs with the corn, and is satisfied it will pay, giving instances to prove his position.

BRATTLEBORO INSTITUTE.

In answer to a question by Mr. Thayer of Guilford, Mr. Lane said that cattle could not be fed profitably up to four or five years of age. Young animals were the most profitable to feed. His neighbors had raised a number of calves that had been sold for $40 or more, each. They were given food similar to that which made his 1200-pound calf.

Answer to a question by a gentleman from Vernon: Cotton-seed meal is not good for pigs; Prof. Sanborn tried it, and the pigs were killed. The question whether cows are injured by feeding cotton-seed meal, and whether the flavor of the milk is affected, being again discussed, Dr. Cutting said the injurious effect might be owing to bad meal. Pure cotton-seed meal should have a light, yellowish color. That having a dark or bluish tinge might be affected by a poisonous, fungoid growth.

Mr. Whitman of Brattleboro, inquired for the best feed for sheep. Answer by Mr. Lane: One-third each, by measure, of bran, oats and corn. For sheep he prefers whole corn to corn meal.

Mr. Loren P. Smith gave a short lecture on "True economy in buying food," treating the subject in its relation to chemical science and illustrating by charts the composition of various grain foods, and comparing their nutritive value, as shown by chemical analysis, with their cost. He recommended corn meal and bran as an economical grain food; but in his neighborhood malt sprouts, costing $12 per ton, was much the most economical food, according to its nutritive value, to feed as a mixture with other grains. He believed it nearly equal to cotton-seed meal, which sells at his place for $27.50 per ton.

The question of the value of cob meal was again discussed, and the majority believed the cobs alone of some value, besides their effect as a dilutent when ground with the corn.

BENNINGTON INSTITUTE.

Mr. Pember thought that more depended on regularity in feeding than the number of times. This was concurred in by a farmer present. Mr. Bottum feeds his stock seven times a day, considering that in his way his animals eat more and with a better relish than if fed only twice a day. He keeps a winter dairy, hence the best of care is necessary. Mr. Pember said a few words in relation to ensilage, being favorably with the system, and he believes it will be of much value to Vermont farmers.

As regards sheep he thought that twice a day is enough to feed them, and good hay will do well enough without grain. Would not keep in a pasture with cows, as in such cases they will get the best of the grasses. They will thrive better on poor pastures than cattle, and he believes would be useful in their renovation. Mr. Davis would give the morning's feed at two different times instead of once, and the same at night, believing this to be the better way. The horse is unlike the cow in internal economy, and can be fed differently. Would feed horses three times a day, not giving too much bulky food, but some of a more concentrated form, as grains of different kinds. Stables for horses should be well lighted, moderately warm and well ventilated.

BRADFORD INSTITUTE.

E. R. Towle read a paper on the "Winter care of stock," after which a lively discussion ensued.

Mr. McLane asked in relation to the silo, whether the members of the Board are of the opinion that the system of ensilage is destined to be permanent in character? Mr. Davis answered decidedly in the affirmative, and then proceeded with remarks on the snbject of Mr. Towle's paper. He does not believe in keeping manure in a stable with the cattle. Would raise the barn and have a manure cellar. The stable should be warm if the cows are expected to give much milk in cold weather. Would not feed stock out of doors at all, as this is wasteful, and sometimes dangerous to the animals. There should be regularity in feeding, and great care exercised so as not to give either too much or too little at a time. It is an advantage to cows giving milk in winter to have water moderately warm. Recommended the feeding of cotton-seed meal with other provender, a small quantity at a time. It should not be fed to young calves, but for fattening animals it is excellent.

Hon. J. O. Adams, Secretary of New Hampshire State Board of Agriculture, was introduced, and occupied a short time on "Feeding Stock." The stomach of the horse being so much smaller than that of the ox, requires being fed oftener than the last in smaller quantities. Would feed hogs three times a day; but twice might be sufficient for cattle and sheep. Care should be exercised so as not to have the animals run down in condition. Should feed with reference to what is required of the animals, as cows for milk, oxen for labor.

If we compel animals to eat a large amount of straw, there should also be given some concentrated food to make a more perfect ration, thus making the straw of much greater value than when fed alone. Denounced the practice of allowing young animals to run out in the winter, getting their food from the straw stack or other inferior fodder. Would not feed cotton-seed meal to young calves; linseed meal is much better. Never permit the young animals to stop growing, as at this time they will give a greater profit for the expense of keeping than those that are older.

If pigs are cared for as they should be the greatest profit is obtained between the ages of six weeks and ten months. He gave some very interesting and convincing arguments to sustain his position, and was listened to with attention.

CABOT INSTITUTE.

Dr. Cutting then opened the session with a general address on "What may be Learned by Observation." He condemned the practice of feeding straw alone and then the hay in the same manner. The two should be fed together with a small quantity of concentrated food, or cotton seed meal in addition, to be the most profitable. The stable should be made warm even to sixty degrees, but they should be thoroughly ventilated. The last is very important, otherwise the fodder and the milk will be contaminated and the health of the animals impaired.

CHELSEA INSTITUTE.

Mr. Smith didn't think that wetting fodder increased its digestibility or the yield of milk, merely a matter of convenience; would always mix grain or meal with some cut fodder or chaff. Fed twice a day.

FAIRFAX INSTITUTE.

Mr. Davis next spoke on the feeding of cows and the production of milk. He believes in feeding both the land and animals well, finding in this his profit. He stated that there were fifty dairies in Vermont of fifteen cows or over, that reach an average production of 300 pounds each. Can feed two quarts of cotton seed meal to a cow per day, but would not advise farmers to feed as much as this at first. Commence with a small quantity at first and increase gradually.

HIGHGATE INSTITUTE.

Loren P. Smith gave a short address on "Feeding." He advocated good feeding from the commencement with the proper kinds of food, in this way getting the greatest amount of growth and development at an early age, and at a saving of time and cost. Farmers should raise so far as possible the grains required to be fed upon the farm, but as this cannot always be done he would advise farmers to purchase feed rather than do without it. Charts were produced to show the feeding values of different materials, and their proper combination for stock.

Mr. Pelton asked as to the value of rye for feeding. This has been found by some to be very good mixed with oats and corn or cotton-seed meal. Only one in the audience feeds cotton-seed meal. Mr. Goodwin would advise the farmers to sell part of their corn and use cotton-seed meal instead.

Mr. Pelton feeds rye and corn together, with goods results. Mr. Hoadly of Swanton has fed cotton-seed meal to cows, but does not think the butter is of as good quality. Has fed it with oats and barley and only one quart per day. Mr. Goodwin told the farmers not to feed rye alone, as it is too laxative and should be mixed with other grains.

LUNENBURGH INSTITUTE.

Mr. Davis asked if cotton-seed meal had been fed to cows to any extent here? If so, how is it liked? Charles H. Cole, from his own

experience, is in favor of feeding it, but some farmers are afraid of it. He does not discover any bad flavor from feeding it, either in the milk or butter. Would not feed alone, but mix with shorts, middlings, corn ground on the cob or oats.

What combination of feed is the most profitable for a dairy during the winter?

Mr. Grant has used middlings and cotton-seed meal. Would use 200 pounds of middlings and 100 pounds of the cotton-seed and feed from 5 to 6 pounds of this to a cow daily. This produces good results with him.

Dr. Cutting stated that the benefit received from the feeding of cotton-seed meal in the increased value of the manure should be taken into consideration in this matter.

ORWELL INSTITUTE.

C. H. French, principal of Shoreham academy, then followed with an address on "Feeding," showing how the feed affects the size of the butter globule and thus affects the time necessary for churning; spoke at some length on the philosophy of feeding, illustrating how the food furnished should contain the elements and in about the same proportion as in the animal, which is about 2 1-2 per cent. of albuminoids, 12 per cent. of carbo-hydrates, and .6 of 1 per cent. of fat. If we know of what each kind of food is composed, we can so combine them to receive the greatest benefit, and thus use all the coarse fodder to advantage. Thus it is more profitable to feed for milk than for beef, as in addition to the butter, the skim milk will make about as many more pounds of beef or pork. The address was full of practical thoughts and suggestions, and was intently listened to.

The subject was further continued by Mr. Pember, urging upon the farmers the importance of studying this matter more, and being able to use up all the coarse fodders to the best advantage; also showing the relative amount of butter and cheese contained in average quality of milk.

Mr. French, being called upon, gave a description of his father's barns, in which are kept about 200 cows. Feed is nearly all cut and steamed; ties up the cows with chains attached to the side of a V shaped stanchion, movable up and down; has a large silo and thinks very highly of it; sells all the milk needed in Portland.

PITTSFORD INSTITUTE.

Mr. L. P. Smith, of Trumansburgh, N. Y., gave an excellent practical address on "Soiling." It was chiefly a recital of his own experience, showing how he had carried twenty-five cows through the summer without pasture, and with very satisfactory results. He finds that soiling is growing in favor among many farmers, particularly where land is high and under a good state of cultivation. He would have a variety of crops sown at intervals of a few days, so as to furnish a continuous supply, and would also aim to raise two crops on the same land. He thinks very highly of fodder corn, as a larger

amount can be grown on the same ground than of any other crop; would never plant anything but sweet corn, as that contains much more sugar and starch than common corn, as analysis show that double the amount of sugar and much more than that of starch.

SOUTH HERO INSTITUTE.

Mr. Goodwin was then called upon to give his experience in feeding straw. He alluded to the importance of the proper election of cows for the special purpose desired, and then combine the food in the proper proportions. Has fed no hay to his cows this winter, but fed corn fodder, and straw, corn meal and cotton-seed meal. Feeds corn fodder cut, in the morning, then three parts corn and cob meal mixed, and one feed of oat straw; his cows never did better in butter or condition than they have this winter.

Mr. Gordon asked about the value of roots for butter. Mr. Goodwin didn't think they were worth hardly anything for that purpose alone, but when properly combined with some richer foods aid digestion and renders the other parts of the food more available.

Mr. Fletcher inquired the best time to cut timothy. Mr. Lane would cut it for most of stock just as it was fairly out of blossom.

Mr. S. L. Gordon inquired if cotton-seed meal did not injure the quality of the butter. Mr. Goodwin was sure it did not unless more than two quarts per day were fed.

Major Corbin spoke of his experience in the southern states, where cotton-seed is used largely as a fertilizer, by dropping the seed whole in the row and planting the cotton above it. In this way it is considered fully as valuable as commercial fertilizers, thus showing that it has a large manurial as well as feeding value.

WHITE RIVER INSTITUTE.

Mr. C. B. Ballard is not in favor of steaming food for stock at the present time. Thinks that ensilage can be raised for one dollar per ton, and twelve tons will keep a cow a year. Is very enthusiastic in relation to ensilage, and very well may be so with the excellent results he is experiencing with this system.

Dr. Cutting made some statements in regard to the silos and stock belonging to Mr. Ballard. The ensilage is the most perfect of any yet seen, and the cattle appear to be in the finest condition. Believes that farmers should investigate the subject, and where practicable adopt the system. From his own experience finds that corn can be raised on the right kind of land, from year to year, with a small annual amount of fertilizers. His hay costs in the barn not more than $2.50 per ton, and should in this case afford a good profit when sold at $10 per ton. Thinks that our crop of hay should be largely increased.

Fifteen tons of ensilage per acre will be a good fair average crop. Believes that ensilage will be for the farmers of Vermont what grain raising is to the west, and perhaps gives us the advantage. Speaking in relation to the fall feeding of meadows, he believes that what farm-

ers term "run out" is simply "fed out," by allowing stock to run on the fields too long.

WAITSFIELD INSTITUTE.

Mr. Lane is of the opinion that farmers are too apt to feed all animals alike without reference to kinds, age or use. This is wrong, as it entails a loss; a growing animal, a cow giving milk, or a fattening animal, require a different ration of feeding material to have the best effect. Farmers should be so informed in this matter as to be able to so feed as to produce the most successful results.

A farmer asked what should be fed to cows with straw, to make it equal to hay in value. It was answered that corn and cotton-seed meal, two of the first to one of the last, perhaps three quarts in all, would be about right. Mr. Smith would feed straw to fatten animals instead of cows. Clover hay may be considered very near a perfect ration of itself. To get good clover hay Mr. Lane would cut when in blossom, cure as rapidly as possible and put into the barn quite green. In answer to a question, would cut in the afternoon in good weather, the next day spread with a tedder twice and rake up before night and put in the barn or in the cock. Would put all in a tight mow instead of spreading about, and would not object to treading down. When the mow is full would put a foot of straw on top to absorb the moisture from the clover.

One farmer had fed cotton-seed meal to calves and it killed them. It should never be fed to young calves, as it will result like this.

Mr. Jones would feed meal dry, putting it on top of the hay twice a day.

BERLIN INSTITUTE.

Dr. H. A. Cutting, secretary of the board, gave an address upon the "Capabilities of the Plant to Seek its Food," at Berlin this evening. It was an entertaining address, and was followed by a series of questions upon fertilization, which were ably answered.

Mr. J. N. Perrin remarked upon winter fertilization, that he tried it with good results last winter, and was doing the same this winter. His last winter was upon a side hill, and at the bottom of the hill he left a rod or two to be fertilized by the wash which he thought might take place, and he saw colored water running in little brooks down the hillsides, settling in upon the unfertilized part, and he supposed that would be surely fertilized, but he plowed and sowed, and his grain was good where he spread his manure, but down below where he supposed much of his plant food had gone there was no apparent fertilization, the grain being small and short. From that he ceased to worry about his manure washing, as he found Dr. Cutting absolutely correct in his statements last winter, and he was satisfied that winter was the time to fertilize.

Does the burning of bones affect their manurial value? Practically it does not, burning only destroys the fatty matter which is no use to the growing plant.

BRATTLEBORO INSTITUTE.

The admirable lecture of Secretary Cutting, on "Fertilizers and Fertilization," Thursday evening, should have been heard to be appreciated. At the conclusion of his lecture Dr. Cutting was plied with questions for more than half an hour.

Mr. Alexander asked if he would put no manure in the hill for squashes. Dr. Cutting would not manure even squashes in the hill. Does manure evaporate and lose its fertilizing properties by exposure on the surface? Ans.—No; that is an old-fashioned idea. You cannot possibly evaporate the mineral elements of the manure.

Mr. Goodenough of Brattleboro asked: What keeps up the fertility of land at the cost of 60 cents per acre? Dr. Cutting replied: "After finding what the soil needed and supplying it in proper quantity, I have kept it fertile with 60 cents' worth of phosphate per year.

Mr. I. B. Taft used to plow under manure, but, having left part of a tobacco field in the fall with the manure on the surface, he found the plants so much better on that part that he has since applied manure near the surface. He considers three loads applied in the fall or winter, on the surface, of as much value as four applied in the spring and plowed under. Dr. Cutting said: More than three for four in his opinion.

Mr. Goodenough inquired: In what form would you apply phosphate. Ans.—Ground bone dissolved in acid; or, if the land needs potash, bones dissolved in ashes. Bones should be prepared with ashes three months before being used, if unground. My method is to pack bones in barrels with ashes, packing ashes close in around them; then place the barrels in a cellar where they will not freeze and wet with hot water as much as you can without leaching and let stand for six months or a year, and the bones will be pulverized quite well, and what are not can go in for next year. If burned it will expedite the process somewhat, but I never found need of it.

Ex-Gov. Holbrook endorsed the idea that manure plowed in was not as valuable as if applied on the surface. He had found very great advantage in the use of some kinds of muck. That formed from hard wood was most valuable; that from pine and other soft woods was not valuable. He had found salt in small quantities a good fertilizer. He had had some experience in reclaiming land by plowing in green crops; had plowed in two crops of buckwheat and a crop of rye on a piece of poor land with extremely favorable results.

Mr. Sargent of Brattleboro called on Dr. Cutting to tell how he redeemed poor soil so that it produced three tons of hay to the acre, without plowing. Ans.—Harrowed, and sowed grass seed; found what was needed and supplied it. Did not apply more than five loads of stable manure per acre, and then potash or phosphoric acid or both, as found desirable.

Mr. Alexander said he had been a farmer for eighty years. At fifty he knew about as much about farming as one of his oxen. He left a 100-acre farm in Guilford, and has since cultivated four acres, getting $200 profit per acre. He fertilizes his ground for squashes in the hill, and can beat any man in this state raising them.

There is a secret about squash seeds; those commonly sold are good for nothing, and good squashes can never be raised from them, whatever be your religion or politics. He had told people that they had failed to raise squashes because they hadn't the right kind of religion; but he knew it was because they hadn't the right seed. Send direct to Gregory, and you will get pure seed. Mr. Alexander advised all farmers to plant next spring at least one square rod of strawberry plants.

Chas. I. Pierce, of South Vernon, brought a sample of Canada ashes such as have been sold in Vernon and other towns by the car-load, retailing at thirty-four cents a bushel. The sample was inspected by Dr. Cutting, and pronounced to be marl and coal ashes, worth as a fertilizer, on land where lime is needed, not over twenty cents a barrel. (Prof. Sabin has analyzed them and found they contained no potash of account, and calls them as I do, nearly worthless.)

BRISTOL INSTITUTE.

Prof. Sabin was then introduced and read a fine paper on fertilizers and fertilizing. The relation of chemistry to agriculture is very close. The baker knows if flour, yeast, etc., are mixed together in certain proportions and certain things done, bread will be the result; but the farmer should know all about the nature of his soil and feed it with the right kind of food for his crops. Everything may be in the soil but one thing, and the plant would not have more than a tenth of one per cent. of that essential in its composition, yet the plant would not grow because of it. It would be a waste to feed the soil with anything but that one essential thing. The science of agriculture depends upon one principle. Soil is the receptacle for the material of which the plant is made. He also advised farmers to buy feed for their stock if they did not buy their fertilizer, as this was the next best thing to do. A farm can not be kept up with the barn manure, as all that is taken from the soil is not returned. He did not think it best to buy the fertilizers, paying the manufacturers their large profits, but farmers could buy their own materials and make their own fertilizers for less money.

E. A. Hasseltine made a few remarks, saying although he had not made any extensive experiments, yet he was satisfied from what he had done that commercial fertilizers did not pay him. F. W. Noyes had also tried them on his plat of ground, and the growth of his plants had resembled his own growth,—he was an inch taller when he was sixteen than he is at present.

Henry Lane had used much fertilizers and found that it was done at a loss. Mr. Wright had tried them but was not satisfied with the results.

E. M. Goodwin spoke of one piece of ground that had not had a particle of manure except once in twenty years, but it was still in good condition. He alluded to the theory of plants taking nourishment from odors arising from different substances; denying that it was so. A. D. Searles thought different, and referred it to the professor, who decided Mr. Goodwin was correct.

C. C. Sumner asked if there was any nourishment in carbonic acid which was absorbed by the plants. The professor thought not. A. D. Searles asked the professor to tell what the best brand of fertilizer was. The professor gave it up.

Prof. Sabin thought lime best for wheat in some cases, also some salt could be used. He did not consider fertilizers useless.

The secretary of the board, Dr. H. A. Cutting, gave an address upon "Our capability of feeding plants," bringing out the facts deduced from actual experiment that it was better to fertilize little and often; that we should ascertain what was especially needed, and apply it and that only; that the time to fertilize is of the greatest importance, and that time is earlier in the spring than it is usual to apply the fertilizer.

BARTON INSTITUTE.

Dr. H. A. Cutting gave a lecture upon "How we may make Plants grow." He explained the results of his experiments and the methods used in preparing the ground and the amount of fertilizers used. He does not believe as much stable manure as is often applied to cultivated land can be so applied with profit, and he believes better crops can be raised cheaper by using some chemical fertilizer in connection with it. He advocates the use of salt, land plaster, phosphoric acid from bone meal, and ashes or potash when needed. He believes every farmer who keeps stock has nitrogen enough for his farm in their manurial product, but believes both fluid and liquid should be saved.

The doctor was listened to with great attention, and at the close he was asked several questions which were as judiciously answered.

Dr. Skinner of Barton then spoke highly in praise of the instruction given by Dr. Cutting, saying that he had ascertained from experience the truth of many things in the lecture, especially that fall and winter application of manures were judicious and profitable.

He further said he was pleased with the general work of the Board and believe for once the right men were in the right place.

CABOT INSTITUTE.

At 7 : 30 Dr. Cutting took up the subject assigned him on the programme, "Plant Growth," and delivered an elaborate and very instructive lecture. After the address some questions were answered by the doctor. Would always apply manure or fertilizers broadcast and not in the hill. Is not of opinion that manure loses much by evaporation. The freezing and thawing of manure spread on the land in winter is an advantage rather than otherwise.

Mr. Kenerson could not see the advantage of spreading manure in winter. Is of opinion that when put on frozen ground it will work away. He has the best results with manure spread in fall or spring. Dr. Cutting further explained and confirmed the theory of winter application, but would not advise farmers to adopt the system on their land unless it is found to work well.

Mr. Pitkin was not in favor of winter manuring.

The doctor stated that the sediment which is deposited on some meadows is silt and not manure. An excess of any fertilizing matter is injurious to the crop.

A farmer present stated that he has long practiced applying manure to plowed land in October with good results.

The doctor stated that superphosphate made from bone is superior to that from phosphatic rock.

Mr. Kenerson made some remarks, endorsing the system of plot fertilization, and was of opinion that if farmers would practice this and then purchase only the materials that are needed, much money would be saved that is now paid for manufactured fertilizers.

Mr. Goodwin endorsed the remarks of Mr. Kenerson, and then spoke strongly in favor of the winter application of manure.

CHELSEA INSTITUTE.

An essay was then read by Mr. L. P. Smith on "Practical value of nitrogen in farm economy," treating of the difficulties that surround the subject; the discoveries and latest theories in regard to it and of the great value of the element of nitrogen to the farmers, and the importance of a proper understanding of the facts and principles in regard to it as far as known. This was followed by Mr. Lane of Cornwall, in some remarks on fertilization and clover plants.

It has been found that three ingredients are necessary—nitrogen, potash and phosphoric acid; if one or two are lacking there will not be a good crop. One or more are usually lacking. Farmers should experiment and find out which one or more is needed. Thinks he can furnish nitrogen to his soil cheaper than by buying commercial fertilizers. It is the most expensive ingredient in our fertilizers, and value of our fertilizers has been to some extent based on the amount of nitrogen they contained.

Prof. Atwater found that the addition of twenty-four per cent. didn't pay, and as amount increased loss was greater. Can get our nitrogen from our barnyard manure; should be used with great care. Can also get it from clover. Shouldn't try to farm without it. Roots of a clover crop are as good as a coat of manure.

Ex-Governor Hinckley. Farmers here say that ashes don't pay. People come here from Randolph and pay twenty cents a bushel, and say it pays them. Seems too bad to send off ashes if we can use them to advantage. Would like to know if it would pay here.

Mr. Lane. It was found that ashes would double the hay crop in Walpole, N. H. In Pomfret, where ashes were applied, it showed for ten years afterward, even on top of a hill. Each one must experiment for himself.

Mr. Lincoln. I dissolved bone—going to compare with Bradley's phosphate. He had tried both on corn and potatoes, and the dissolved bone did a good deal the best in each case.

Mr. S. P. Smith. The difference between dissolved bone and a superphosphate is, that the phosphoric acid in the phosphate may come from dissolved rock; they also add some nitrogen and potash.

Mr. E. M. Brown planted four rows of potatoes three and one-half feet apart: one hundred and forty-four hills in rows, hill two feet apart in row.

		Good Yield.	Small.	Total.
1 row.	Nothing	138½ lbs.	34½ lbs.	173
2 "	1 bushel of ashes	133 "	34 "	167
3 "	1 peck ashes, 10 lbs. of phosphate	228 "	56 "	284
4 "	10 lbs. phosphate	241 "	44 "	286

Yield in favor of phosphate and against ashes.

Mr. Walker spoke of a piece of land where ashes had been spread from a pot-ash factory years ago. Over that spot the grain will lodge to-day.

Mr. Willis Scales thought that superphosphate could be made at great saving of expense.

He used 415 pounds of bone meal and 443 pounds sulphuric acid. (This would cost them about $31.)

This he put together according to Cutting's formula, and extended to one and a half tons.

This he used in test with Buffalo and Bradley's, on corn.

He planted six rows with Bradley's, then six rows with his make, then six rows with the Buffalo, then alternated, changing order. When he cut up, he cut the two middle rows in each experiment, and found his own make worth more than either of the others though costing about half as much. This was satisfactory demonstration to him that farmers should all manufacture their own fertilizers.

ESSEX INSTITUTE.

Dr. H. A. Cutting gave an interesting lecture upon the "Power of Assimilating Food by Plants." He illustrated their capabilities, their power of selection, and how we could best aid them. It was a lecture all should hear and one in which all were much interested. At the close of the lecture proper, the doctor was kept on the stand for a full hour answering the following questions:

Do any of the elements of plant food pass off by the melting snow or water?

They do not to any extent, as numerous experiments have demonstrated.

Will any of the strength of the manure pass off in the air by evaporation?

No, nothing of value to the plant is lost in this way.

If the manure should be washed away bodily, of course it is mostly lost; but if it is only covered with water little is lost.

Can one tell from the original growth of timber, the rocks, etc., what kinds of fertilizers such land most requires?

This cannot be done with any certainty; experiments will best determine this.

Clay soils do not generally need potash.

All land in Vermont is benefitted by a small amount of salt. A cheap refuse salt will answer the purpose just as well. About one and one-half bushels per acre, once in three or four years, is generally sufficient.

ENOSBURGH INSTITUTE.

Hon. Henry Lane, member of the board, gave an interesting lecture on the "Rotation of Crops." He stated that much of our success as farmers depends on a proper rotation of crops; the restoring again to the soil in some form what has been taken from it. Natural laws illustrate the necessity and benefit of rotation; thus cut off a growth of hard wood, and another of fine or soft wood, if permitted, will spring up in its place, and the reverse will also be the same. All plants do not require the same elements of fertilizing; hence the necessity of such a rotation as shall take up all these elements in a series of years. Rotation will be of little use without proper fertilizing, and the same system will not be alike adapted to all soils or farms. As a general thing farmers alternate hoed crops with those that are sown. Would give prominence in a rotation to clover, as it is an important crop in many particulars and is an excellent renovator of the soil. Most any crop succeeds well after clover. Corn is also a good crop for the improvement of the soil, owing to its habits of growth, the conditions of fertility and cultivation. This was an excellent paper.

Some questions were answered as follows: Does not feed the aftermath. Soil mostly a clay, and on this plaster acts beneficially. Sows plaster on the snow in the spring. Sown in September it produces good crops the next year. Applies 100 pounds per acre. Stock, principally sheep. Would feed either hay or grain in the autumn in preference to grazing the aftermath of meadows. Probably the drouth more seriously affects the hay crop in the Champlain valley than in Montgomery. Is of the opinion that were there plenty of moisture good crops of hay could be produced almost perpetually without fertilizers. Although he believes that for the production of large crops a considerable amount of manure must be used, yet there is a limit to this, and too much can be applied to be profitable on most lands. Would re-seed bare places in pastures wherever they are to be found, at the proper season of the year.

In the evening, Prof. A. H. Sabin, of the University of Vermont, gave an instructive lecture on "Fertilizers." He said the value of stable manure depended largely upon the amount of grain fed to the stock. It is a question whether it may not be a cheaper way in which to obtain fertilizers by means of keeping more stock and feeding an increased amount of grain, especially of those kinds that will produce a very rich manure, as corn, cotton and linseed meal. Where it is necessary to greatly increase the production of crops and improve the soil it is quite essential to employ commercial fertilizers. As these are generally easily soluble and active, quick returns may be expected from their use. In speaking of the value of the analysis of fertilizers, he stated that he has such confidence in the results obtained, that he would not be willing to pay more for a certain kind than the analysis will warrant. There is nothing we buy that is so easily adulterated as artificial fertilizers, and the only way by which this can be detected is from analysis. All fertilizers must be in a soluble condition to be made available as plant food. For this reason farmers should under-

stand the nature of the fertilizers they require or are purchasing. Some kinds will act quickly, but do not last long, more than for the present season; soluble superphosphate and others will last longer, as ground bone. The potash compounds are mostly soluble, and the nitrogenous compounds to a less extent, although in some combinations they are nearly insoluble. If hair or ground leather are found in purchased fertilizers, farmers may rest assured that they are paying a large price for what will be of little use to them.

W. H. McAllister asked the Professor if he would not give a formula for making superphosphate. He answered that it is difficult and expensive obtaining the ground bone, and advises farmers to join together and buy a bone-mill, and grind their own supplies. He then gave the formula for making superphosphate, as being in about the proportion of one hundred pounds of bone meal to eighty pounds of sulphuric acid; the meal wet first with water until a paste, and then the acid slowly added. Lime, he says, will work well on some soils, and so will plaster and ashes, and this should be definitely determined by experiment on the land. Ashes will drive away ammonia, hence should not be mixed with farm manures, but apply each separately. An analysis of a superphosphate made according to the formula given was found to be more valuable than the best grades sold by manufacturers.

FAIRFAX INSTITUTE.

Mr. Lane then spoke on "Commercial Fertilizers." Mr. Lane would not advise farmers to purchase fertilizers until they first find whether they are wanted or adapted to their soils, and then thinks that it would be better to purchase grain so as to make more and richer manure. Mr. Goodwin said there may be a necessity for buying some of the elements found in the commercial fertilizers, but not all; so there is the importance of finding out by experiment what is wanted by the soil before purchasing. On some farms a complete fertilizer may be wanted. Mr. Lane said he would recommend anything suitable as an absorbent for the liquid manure.

LUDLOW INSTITUTE.

Mr. Davis, in answer to an inquiry, gave the formula for making phosphate. This has been given before. Mr. Sawyer being called out gave some account of his farming, in which he seems to have been successful. He stated that he does not have to feed sheep or young cattle over three months in the year, which is very unusual here in Vermont; he has a good pasture and for this reason does not feed meal. If the pasture is poor, he was of opinion that it might pay to feed grain. With 125 pounds of butter to a cow he can make money. Would feed meal if he was reasonably certain it would pay.

In answer to a question, Mr. Lane said that he believed that pastures can be improved by keeping more stock and feeding grain. Mr. Hoskinson of Mount Holly believes that a really excellent pasture will afford all and the best material necessary for the production of butter.

Dr. Cutting believed in top-dressing pastures with manure in winter or with a superphosphate, which in his opinion pays as well or

better than elsewhere. Mr. Goodwin spoke of his own practice of spreading manure in winter, and recommended it where the conditions are favorable; he spoke of an experiment with chemical fertilizers, at a cost of $19.50 per acre, with corn. Twenty loads, or five cords, of stable manure were applied to another acre, with just about the same yield of corn. Mr. Hoskinson spoke of the value of clover as an enriching agent.

LUNENBURGH INSTITUTE.

Mr. Henry Lane stated that in his experience he finds the winter application of manure to produce good results and likes the practice. He does not think the manure will lose any of its valuable properties by thus being exposed to the elements during the winter. J. M. Dodge stated that grass lands top-dressed either directly after haying or in the winter do well. In his practice he prefers the first time. Another man has trebled his hay crop by fall application, bushed in in the spring.

The land about Lunenburgh Heights is very stony. Some farmers thought that if all these stones could be removed the land would not be as productive as now. One farmer thought otherwise. For corn he would spread on the manure during the winter, if not on a steep hillside. Mr. Lane advised testing this matter by manuring a part this winter and the remainder another spring.

S. T. Hale would, in plowing up meadow land, get it in a good condition and reseed to grass as soon as possible, usually in two years, as hay is a principal crop here. Mr. Smith of Concord plants corn or potatoes on sod, and the second year seeds with some grain crop, by harrowing simply, not plowing again. The succeeding hay crops are very good. Mr. Lane prefers to plow as much as possible in the fall, and especially on soils with an admixture of clay. He usually stocks to grass in the spring.

MANCHESTER INSTITUTE.

"Fertilization" was taken up by Henry Lane, and treated in a very complete and exhaustive manner. Advised farmers to properly prepare their soil, rotate crops so as to give time for rest and recuperation. In this rotation, clover is a good crop to renovate and enrich the land without any other fertilizer to any great amount. Again, increase the stock to increase the manure. It make a great difference in what shape the surplus crops are carried off of the farm. Successful agriculture in Vermont is stock raising. The lightning rod sale through the State, in its imposition, hardly equalled the sale of commercial fertilizers. If obliged to buy, do it cautiously, first finding by experiment what is needed for your own soils. Many questions with an interesting discussion followed.

Mr. Lane had used many kinds of fertilizers on his farm, but generally at a loss. Perhaps this is usually the case, and should indicate very plainly the necessity of every farmer ascertaining as far as possible what particular elements of fertilization are needed, in order that these only may be supplied. For instance, ashes on the soils of

the Champlain valley produce little or no good, and will not warrant paying ten cents per bushel, while in other parts of the State, in the Connecticut River valley it is said, they produce excellent results, and readily command twenty-five to thirty cents a bushel. More attention should be paid to saving the manure already made on the farm, and make as much more as possible by every means at command. He alluded to the importance of using concentrated food for stock as a means of making more and a better quality of manure. Would pay particular attention to the saving of the liquid manure by means of absorbents and otherwise as a great gain. In his own practice he prefers to feed grain to stock, purchasing when necessary, to buying commercial fertilizers. Thinks that farmers do not usually get the full value, according to analysis, of purchased fertilizers. It is probable, however, that the standard of value has been raised considerably within the past few years. Our new fertilizer law should now be some protection to the farmer, as to the character of what he buys. He considers that the agricultural value of these fertilizers will vary greatly from conditions of soil, cultivation, season, etc. He stated that two hundred and fifty tons are annually sold in Addison county, and probably more than this amount is used in other counties in the State. He thinks that farmers are often deceived in the appearance of crops treated with commercial fertilizers. These usually give an early and vigorous growth of stalks, but there is a failure later in the season to perfect the crop, often entailing a loss. From the results of numerous experiments it has been found that nitrogen, the most costly ingredient in commercial fertilizers, is not needed on most farms, or only in small quantities, and should not therefore be inclosed in these fertilizers.

It will be seen that Mr. Lane is very conservative in relation to the use of commercial fertilizers, not advising their use until the other manurial resources of the farm have been made the most of; then, of course, he would not be averse to employ them if it can be done at a profit, or with a reasonable certainty of getting the purchase money back again with a fair margin for application. He is greatly in favor of the use of clover for the improvement of the soil. If a farmer can purchase cotton-seed meal, bran, etc., to feed with the coarse fodder of the farm to fattening stock, and get therefrom the full value of the grain and fodder fed, leaving the manure as profit, it may be considered as doing very well.

Dr. Cutting followed with some remarks in which he stated that if farmers would obtain the greatest result from their stable manure, great pains must be taken to save all the liquid portions and not allow the solid part to become deteriorated by continued exposure to the weather, as is often found to be the case. It depends in a great degree on the discrimination of the farmer in the application of fertilizers, to give only what is needed. There is too often an excess of some ingredient given and a loss is sustained. If there is an inclination of crops to fall down or lodge, it is a pretty certain indication of an excess of nitrogen. In such cases less of this should be given and more of mineral substances, as phosphoric acid, potash, plaster, or

even salt. Some soils may require a perfect fertilizer, and the only way by which a farmer may determine this on his land is by trying plot experiments. He made some excellent remarks in relation to the comparative and actual values of fertilizers that should be of service to farmers. He gave an instance of the application of ashes on his own soil. Five bushels per acre produced an increase of nearly one ton of hay per acre.

Dr. Cutting stated that a farmer should so fertilize his land as to get a profit, neither giving too little or too much, and he believes that if we farm so judiciously as to obtain a reasonable profit, we shall be more likely to keep our boys at home, notwithstanding some might think otherwise.

Mr. Jones of Waitsfield spoke of raising fine crops of corn with a fair quantity of stable manure and superphosphate. Dr. Cutting remarked that fertilization of pastures with the application of seed at same time is an advantage.

MONTGOMERY INSTITUTE.

E. M. Goodwin stated that great care should be exercised in the manufacture and saving of the manures. Would have manure housed. Plenty of bedding or absorbent should be used. Make the most manure from all the animals and fowls possible. Would save all the wood ashes and bones to be obtained, to be prepared and used as fertilizers. From his own experience and observation believes that surface application—that is, harrowed in on the surface—to be the best method. Coarse or strawy manure should be plowed under very shallow. Would apply all fertilizers broadcast, and not in the hill. Thinks the best time to draw and spread manure is in winter on the snow. This practice was pretty thoroughly discussed at the farmers' meetings last winter, and has been followed by many in the State, generally with good effect. The quality of the manure made on the farm will depend largely on the quality of the fodder given, being much the best where more or less of grain is fed. A discussion followed. Mr. George Porter gave as his experience with corn, by spreading on manure broadcast and then putting some in the hill; but as the last was extra should account for the result in part from this application.

Mr. Goodwin thought where manure is put into the hill a larger amount of stalks will be grown, but not of the grain. Does not believe that manure in the hill will increase the earliness of the crop. Advised planting medium early varieties rather than late. Mr. Comings of East Berkshire gets corn earlier by manuring in the hill. This was also corroborated by Mr. Porter. He uses twenty loads per acre for this purpose, and forty or fifty loads spread or harrowed in. Dr. Cutting believes that this must be a wonderful country to stand such heavy manuring. Gave some of his experience in relation to applying manures. Believes that if farmers would weigh and measure more they would be better able to judge of the real results.

Mr. Porter spoke in relation to saving liquid manure. Uses sawdust for bedding and as an absorbent; houses under a shed; had bet-

ter results with rotten than green manure; in this way has about a year's stock ahead. Likes the practice of surface manuring when the snow is not too deep. Mr. Pratt favors drawing out manure in spring from the cellar just before sowing or planting. This was endoresd by the secretary as next in value to spreading in winter. Joel Swan would plow in plenty of manure from the cellar and about as deep as possible. The secretary said the gentlemen of the board are not theorists as some would believe, but possess practical information from their own experience and observation.

It was evident from the discussions, that the same practices will not always produce the same results under all conditions and in all locations; consequently judgment and care is necessary in every case, in order that farmers may know what is best for their particular interests.

PASSUMPSIC INSTITUTE.

Rev. J. Ward put manure out on snow in winter (last), a bad time to wash on side hill. No damage from washing; received a very satisfying result.

POULTNEY INDUSTRIAL ASSOCIATION AND INSTITUTE.

Dr. Cutting addressed the meeting on the subject of "Plant Growth and Cultivation." He introduced his remarks with a consideration of the continuance of plant growth, giving illustrations which proved that roots seemed to have discriminating power to gather food. He instanced clover roots which have been found eight feet in length, and roots of corn extending down seven feet and even ten and twelve feet in every direction. True roots take no nourishment but send out rootlets from which extend innumerable little tubes which gather the nourishment. Any strong solution of plant food in water closes the mouths of these minute projections. Hence the necessity of judiciously fertilizing. Near barn yards the vegetation is killed by excess of plant food. How many farmers reduce not only their profits, but their crops, even, by over-fertilization. It is the field that is over-fertilized that produces rust and lodged crops. Experiments may be made with house plants. The phosphorous match which the house-wife sticks in around the plant in the pot stimulates the plant to more vigorous growth and causing it to blossom is a hint to the farmer to use phosphorous in his fields. The ashes which she also uses suggests the need of potash. The speaker here gave a simple method by which red spiders, lice and the like on plants might be effectually exterminated without injury to the plants. Make a solution of saltpetre, in this soak a cloth, wring it out and let it dry, then wrap the cloth around some tobacco in the form of a cigarette. Take a box large enough to hold one of your largest plants, place in it the plant, lay your touch cloth and light, then close with a glass cover making it nearly air tight.

The cloth will burn up entirely, the foliage will seem to wither, then take the plant out and set in a dark place for about two hours, then wash the leaves with soap suds.

If farmers could double the rain fall in summer, getting 40 inches instead of 20 they would double their crop. He then spoke of the value of dews and of the method of increasing the moisture on the land by attracting dews. Sulphate of lime (land plaster) or salt, since they make the soil cooler than the atmosphere, are used for drawing and retaining the moisture, but farmers should use these with understanding. All that is necessary to start or sprout a plant is stored in the seed itself. The danger of over-fertilizing plants is such that they may be stimulated at the start but fall behind in maturing. Every judicious farmer will supply what his soil requires. This cannot be done without experimenting. His own experiments showed that of two fields, apparently just alike, one required 25 pounds of phosphate of lime to obtain the maximum crop, the other 16 pounds of potash. Experiments on his own lands with phosphoric acid, potash and nitrogen showed that wherever the latter two were used, either alone or in combination, there was an actual loss. Many a farmer is mistaken in supposing barn yard manure to be a universal fertilizer.

Here the speaker gave the results of his experiments last year in the use of mineral fertilizers, per acre:

	Tons.	lbs.
Without any	2	1,485
40 lbs. of bone meal, 1 per cent. of phosphoric acid, soluble	3	1,484
200 lbs. Ammoniated superphosphate	2	1,780
200 lbs. Bone black, dissolved	2	1,900
100 lbs. Plain superphosphate	3	136
200 lbs. Bone meal, fine ground	3	5
200 lbs. Slate dust	2	1,700
5 bushels Ashes	3	1,600

The next year he will use ashes, 5 bushels per acre, and expects to get $3\frac{3}{4}$ tons of hay per acre.

The speaker advocated the fertilization of fields in winter, demonstrating that fertilizers spread on top of the snow would reach the earth at just the time when the plant is ready for the food, and showing the avidity of ice for plant food and for protecting the ammonia. He disapproved of fertilizing meadows in the fall, as the little rootlets would take up the food and the stalk buds be ready to burst into life when they ought to go into winter quarters.

Why not take the same judicious care in feeding the plant as an animal? Plants require food but once a year. Some farmers fertilize one year and then let the land go ten years. If the average amount were put on every year the best results would be produced at no more expense. Two farms on the Connecticut river, much alike in appearance, were compared, by which it was shown that by proper treatment of the soil droughts might be mitigated.

At this point Dr. Cutting announced his readiness to respond to any questions. What time would you sow plaster? Early in spring; as soon as the snow is settled so it will not drift; sow on the snow. How many bushels of ashes would you recommend to the acre? There is no rule. I shall use five bushels on my land next year. Determined by experiment. Leached ashes, as commonly leached, if

bought in leach barrels, are as good or better than unleached, since they are enough more compact to make up for the lye abstracted. Is feeding or after cutting best for meadows? It is best to turn on horned cattle, but keep off colts and sheep. What makes our oats always lodge? The imperfect condition of the soil; probably too much nitrogen. How should plaster and ashes be applied to corn? Spread separately. One before and the other after harrowing. Are coal ashes valuable as a fertilizer? No; only as they contain the ashes of wood used to kindle the fire. When is the best time to sow grass—spring or fall? I always put seed on my pasture and meadows every year in spring. Do not sow clover in September. It won't stand the frost if it sprouts. The only remedy I can suggest for scabby potatoes is to get the land in perfect condition which can be done only by experimenting.

PUTNEY INSTITUTE.

Mr. Williams has greatly improved his hay crop by the application of ashes, and to a greater extent with a fertilizer containing bone, potash aad nitrogen. He found by experiment that with the nitrogen left out the effects were equally good. The bone was cut with acid. Would not feed mowing in the fall.

Mr. Goodwin spoke of his method of mixing bone meal with wood ashes, which produced excellent results on his crops. Does not think much of nitrogen in a fertilizer. Thinks that special fertilizers will be used in increased amounts in the future as it will be a necessity on the farm.

Mr. Williams stated that the top dressing cost a little over $8.00 per acre. The crop was increased one ton the first year. He has improved a badly run down pasture by top dressing with plaster. Once in the year stocks quite heavily so as to keep the grass down close. Lets the cows run in the pasture nights.

"What is the best and cheapest fertilizer for top dressing grass land, when clover, timothy and red top abound?"

Mr. Goodwin replied that in his opinion a superphosphate, with potash, would in general be found what is wanted; but experiment would determine this more definitely.

Mr. Williams said that late last autumn he commenced to top dress mowing land and continued until the snow was too deep to get around, and in the spring. The land first treated and in the fore part of the winter produced the best results.

Mr. Goodwin was of the opinion that much less ammonia escapes from manure than many suppose, but would spread wherever possible instead of putting in heaps.

Mr. Newton of Brattleboro, stated that from his experience great benefit is derived from spreading manure in winter. He had applied to a steep hillside and without waste from washing. This was done in the fall.

SPRINGFIELD INSTITUTE.

Dr. Cutting gave the analysis of various fertilizers and their value in dollars and cents as estimated by the State chemist. He believed

the worth largely in the amount of phosphoric acid and potash contained in the fertilizers. Analysis at hand gave the per cent. as follows:

Phosphoric Acid in	Bradley's	11.18
" "	Pacific Guano	10.19
" "	Stockbridge Potato Fertilizer	9.17
" "	Slack's Superphosphate	13.10
" "	Bowker's Hill and Drill	8.68
	POTASH.	
In	Bradley's XL	2.00
	Pacific Guano	3.03
	Stockbridge Potato Fertilizer	.76
	Bowker's Hill and Drill Fertilizer	1.45
	Slack's Superphosphate	4.50

WOLCOTT INSTITUTE.

Rev. Mr. Winslow of Lunenburgh was introduced, and occupied the first part of the session with an address on "Experimental Farm Education." He spoke of farmers being men definite in their estimates of farm crops or products. They should weigh and measure more and guess less. He referred to the necessity of selecting pure and clean seed as of the greatest importance. In speaking of seed potatoes, found more profit in cutting quite fine and planting thickly. Good tillage is an excellent remedy for drought, and is in a measure a substitute for manure. He gave some fine examples of judicious fertilization and management that should convey a suggestive and practical lesson to farmers. (See his address in Appendix.)

In the discussion which followed, Mr. Winslow explained, in answer to a question, the utility of the winter application of manure. He does not think that late fall application would be really as valuable.

Mr. Slayton asked in relation to the loss of manure by this process of application. Finds fall spreading to produce excellent effects.

Rev. Mr. Morse finds that when manure is spread on the snow it is readily dissolved in spring and needs no pulverizing by hand or with brush. It has been found, with few exceptions that loss will not be sustained by washing from a side hill. It is not well to spread on ice, neither where the land is apt to be plowed in spring. Spoke particulary of the value of experiments on every farm as of the utmost importance in determining the needs and capacities of the soil.

Mr. Slayton asked in relation to Indian meal as a fertilizer. He had heard of its being used as such. No very definite answer could be given. In feeding to stock the fat would be extracted, which is not a manure, while the mineral matter—the chief fertilizing part—is voided with the excrements. He is of the opinion that a genuine superphosphate is more valuable as a fertilizer than bone meal as it is more immediately and certainly made available.

The chairman asked concerning the relative value of hen manure and guano.

Their composition is so variable that at present nothing very definite can be given.

WASHINGTON INSTITUTE.

"When ashes fail as a fertilizer, what would be advised to use next?" Dr. Cutting answered that phosphoric acid should be tried.

The secretary gave some information in relation to the manufacture of fertilizers, upon request, and their application to the soil.

The protection of the law was asked about and Dr. Cutting made some remarks regarding the protection that is expected to be afforded by the new fertilizer law, and the necessity of farmers being very careful in their selection in order to get, if possible, their money's worth, and of those ingredients that are particularly needed on the soil.

THE LAW is as follows:

It is hereby enacted by the General Assembly of the State of Vermont:

SEC. 1. Manufacturers and importers of commercial fertilizers, sold or offered for sale in this State, shall, before such fertilizer is sold or offered for sale, obtain a license from the state treasurer, countersigned and recorded by the secretary of the board of agriculture, for each brand of fertilizer so sold or offered for sale, authorizing the sale of the same in the State, and shall securely affix to each barrel, bag, or other package of such fertilizer the word "licensed," with the number and date of the license. The person obtaining such license for a brand of fertilizer shall pay to the State fifty dollars for each brand licensed, and the license shall be valid for one year.

SEC. 2. Manufacturers and importers of commercial fertilizers sold or offered for sale in this State, shall, before such fertilizer is so sold or offered for sale, file with the state treasurer a bond, with sureties residing in the state satisfactory to said treasurer, in the sum of five thousand dollars, payable to the State, conditioned for the payment of forfeitures and costs imposed on such manufacturers or importers for violating the provisions of this act, and such bond shall be renewed from time to time, as the state treasurer may require.

SEC. 3. Manufacturers and importers of commercial fertilizers sold or offered for sale in this State, shall, before such fertilizer is sold or offered for sale, securely affix to each barrel, bag or package of such fertilizers, a label wherein they shall state in legible print, the name and place of business of such manufacturer or importer, the year of the manufacture of such fertilizer, or, if the fertilizer is imported, the year of its importation, and the net weight of the same, also the constituent parts of such fertilizer, and the percentage of nitrogen, of potash, of soluble, reverted and insoluble phosphoric acid.

SEC. 4. A manufacturer or importer of commercial fertilizers, sold or offered for sale in this State, who violates any of the provisions of this act, shall forfeit to the State one thousand dollars, to be recovered in an action on the bond required to be filed by such manufacturer or importer, under the provision of section two of this act.

And it shall be the duty of the secretary of the board of agriculture to notify the state treasurer of all violations of the provisions of this

act, and the state treasurer shall immediately commence suit on the bond in the name of the State, and prosecute the same to final judgment.

Sec. 5. The word "importers" in this act shall be construed to mean persons importing fertilizers directly from countries without the United States.

Sec. 6. The term "commercial fertilizers," as used in this act, shall be taken to mean compounded and manufactured substances containing or represented to contain two or more ingredients mentioned in section three of this act, but shall not apply to the separate ingredients used to manufacture the same when sold in their pure condition, or to bone meal, land plaster, lime or any substance the product of nature which has not been compounded.

Sec. 7. A person who sells or keeps for sale a commercial fertilizer, the manufacturers or importers whereof have not complied with the provisions of sections one and two of this act, and the barrels, bags or packages whereof, are not marked with legibly printed labels purporting to specify the particulars required to be specified in such labels by section three of this act, shall be fined two hundred dollars.

Sec. 8. The agents in this State of the manufacturers or importers of a commercial fertilizer may sell any commercial fertilizers in their possession in this State at the time of the passage of this act, although the same is not labeled in conformity with the provisions of section two of this act.

Sec. 9. The chemist of the University of Vermont and State Agricultural College shall be ex-officio state chemist for the purposes named in this act.

Sec. 10. It shall be the duty of the secretary of the state board of agriculture by himself, or by some suitable person, to be appointed for that purpose, to draw at least three samples in each year of each brand of fertilizer kept for sale in the State, from stock in the hands of the agents or dealers in the same, which drawings shall be made in the presence of at least two witnesses, and without any previous notice or information of such drawing to the manufacturer, or agent, or dealer in such fertilizer.

Each sample so drawn shall be divided into three parts, and placed in tin or glass vessels and carefully sealed, which shall each have a label placed thereon, stating the name of the manufacturer of said sample, and the brand or trade mark under which it is sold, from what agent or dealer, and when and where the same was drawn, which label shall be signed by the secretary or other person drawing the same, and by the witnesses present at said drawing and sealing up of said samples.

One of said vessels containing said samples shall be kept by the agent or dealer, one shall be kept by the secretary of the board of agriculture, and one shall be sent to the state chemist, who shall properly analyze the same, and duly report to the secretary of the board of agriculture the result of said analysis, stating the methods used by him to determine the amounts of potash, nitrogen, soluble, reverted, and insoluble phosphoric acid, and such amounts; and said secretary

of the board of agriculture shall cause such reports to be published, giving the name of the chemist making the same.

SEC. 11. If the secretary of the state board of agriculture, or the state chemist making the analysis, shall violate, or knowingly fail to perform his duty. as prescribed in said section, or shall collude with any manufacturer of, or agent or dealer in, any fertilizer, to evade the provisions of said section, so as to injure any manufacturer of, agent or dealer in any fertilizer, such secretary or chemist shall, upon conviction thereof, be sentenced to pay a fine of one thousand dollars.

SEC. 12. The University of Vermont and State Agricultural College shall receive five dollars for each analysis made under the provisions of section nine of this act. The secretary of the board of agriculture shall receive fifty cents for recording each license, and two dollars a day for time necessarily spent in drawing samples, and his traveling expenses incurred in the discharge of such duty. Such fees and compensation shall be paid from the state treasury, but the fees and compensation incident to the drawing of samples and analyzing any one brand of fertilizer and recording the license for such brand, shall not exceed the amount paid for such license.

SEC. 13. This act shall take effect from its passage.

Approved November 29, 1882.

While this law is imperfect in some points and effectively evaded in its intent, as I believe in others, it is of great value to the farmer, and future legislation will doubtless render it much more efficient and consequently of greater value.

WHITE RIVER JUNCTION INSTITUTE.

Byron P. Ruggles of Hartland read a paper on "Muck as a Fertilizer," which, being short and of present interest, is enclosed in this report, and reads as follows:

MUCK AS A FERTILIZER.—Ever since I can remember I have heard the opinions of farmers, and have read in agricultural books and papers, that muck is not only a fertilizer but a valuable one, and will amply repay for digging and drawing, even considerable distance. But I have recently read writings of Dr. Sturtevant, director of the New York experimental station, to the effect that muck is *not* a fertilizer, and is of no value in agriculture except as an absorbent or vehicle to convey liquid manure. By way of argument he asks the question, if muck is a fertilizer in itself, why not draw it from the swamp directly to the field, and save the useless labor of drawing it to the barn, composting with manure, and afterward drawing it to the field, perhaps part way over the same road it has once been drawn? The doctor ignores the fact that this question has been many times answered in agricultural books and publications. But inasmuch as it has been taught in these meetings that muck is of little worth except as an absorbent, and that some kinds of muck are worse than worthless for that pnrpose, (last report, page 385,) it seems to me the question needs answering again. That there shall be no mistake as

to what I regard as muck, I have brought a sample. I know some people call pond mud, turf, or any rich soil, muck. I think I agree with most agricultural writers and intelligent persons, in calling this muck, which is decayed vegetable matter found in swamps. Cow manure is only vegetable matter that has had cow taken out of it. The food of cows, which is grasses, grain and roots, is of a very different quality from mosses, ledges, leaves, shrubs and trees, that form muck. But after the cow has taken pretty much all the nutriment, or cow, as I have called it, from her food, the result is very nearly the same as muck. Chemists have analyzed the two substances and declare they are remarkably alike in composition. The use as a fertilizer of from ten to fifteen cords of muck per year for the last eleven years, has confirmed me in the belief that muck *is* a fertilizer, and equal to cow manure. But this is not the whole story. If it was, then muck swamps would be mines of manure all ready for use, and farmers would only have to get it out and apply it to their lands to bring them to any desirable state of productiveness, which would be like quarrying slate already split and trimmed ; like mining petroleum already refined, or raising potatoes already baked. Such cases do not happen. It would be expecting too much of an already bounteous nature. Most all farm or mining products cost more or less hard labor. Yet I have known farmers to consider muck in just this light, and to try it only to be disappointed, and then condemn muck ever afterward. The fact is, muck as it lies in the swamp where it has been stored for countless ages, is in an inert condition. It is sour, perceptibly sour to the taste ; and the acidity is an injury to it as food for plants, and must be got rid of or neutralized before the muck is available as a fertilizer. This is no theory or discovery of mine. I learned it from reading before I began to use muck, and have managed accordingly, and met with anticipated results, as before intimated. Where this acid comes from I do not know ; perhaps it is a product of decomposition. It evidently acts as a preservative of the muck, as salt does to preserve meat. To reduce or neutralize this acidity scientists have given several formulas, most of which make use of an alkali or ammonia, both of which have a strong affinity for acids. One formula requires a certain amount of wood ashes to each cord of muck ; other formulas require soda ash, salt and lime, muriate of ammonia and lime, fish guano, Pacific guano, and stable manure. I believe it is generally admitted that when a manure pile heats or ferments it loses a part of its value by throwing off ammonia, which is in itself a valuable fertilizer. Farmers are told by scientists that in such cases an acid should be applied to arrest the ammonia, and convert it into a soluble salt that will not fly away in the atmosphere, but will remain as plant food. For this purpose diluted sulphuric acid is recommended ; also a solution of sulphate of iron, commonly called copperas, and as a cheaper source of acid and an article that can be more conveniently handled, gypsum or land plaster is recommended, as it is sulphuric acid and lime, and is acid enough to answer the purpose. Now then, as fermenting manure needs acid to save its ammonia, and muck requires ammonia to reduce its acid, it is a very natural and also economical arrangement to mix the two together.

It is natural, for each needs the other, and economical, for it is the cheapest of all methods of making the latent powers of the muck available. It requires no more handling of the muck than is required by either of the formulas mentioned, and the ammonia not only does not cost anything, but would be lost if not saved in this or some other way.

I have heard some farmers say the manure from their cow stables don't heat. I regard this as evidence that they don't bed their cows very well, to say the least. My father did not bed his cows, and manure from his stable was never known to heat; but I have found by thoroughly bedding my cows with sawdust or any thing that has been through a straw cutter, the manure not only heats, but heats as surely and as hot as I ever saw horse manure. When a pile of manure has accumulated at my stable, I spread out a layer of it and cover it with muck, then cover that with manure, and that with muck, and so on till the pile is used up, and when another pile has accumulated I repeat the process. I cover my barnyard with muck in the spring, and after yarding my cows on it all summer, draw it out in the fall, and cover the yard again in the fall, to be drawn out the next spring. For the last eleven years I have used such compost for manuring for corn. In composition it ranges from one-half to three-fourths muck, and I have never failed of getting good crops of corn, averaging fifty bushels of shelled corn per acre.

After reading the paper the gentleman made some further remarks concerning what he considered the history and composition of muck, samples of which he had on exhibition.

Dr. Cutting followed with some remarks in relation to the formation of muck as understood by geologists, explaining more fully the suggestions offered by Mr. Ruggles. Some of the muck found in the State is of value when first taken from its bed and applied immediately to the land, but this usually happens where the beds are in a hollow receiving some richness from the surrounding higher lands. Other beds without this wash will be found to be of little value—indeed may prove injurious where applied. All plant food must be soluble in water to be of any value as a fertilizer. For this reason the muck in the bottom of the bed will be worth much more than that on the surface, receiving in large part the soluble portions of the same. This is also why marl found underneath muck or other deposit is found to be of so much value and not to any inherent qualities. Believes that it should be used either composted with manure or as an absorbent. It is of value for the latter purpose if it can be easily obtained at comparatively little cost, otherwise would substitute ordinary soil or even sawdust if at hand. It very readily absorbs ammonia, and hence is of value in the stable. As the deposits in different places will be found to vary greatly in character, the only true way in which a farmer may usually determine this will be to try it on the soil.

Mr. Ruggles made some further remark on the structure and composition of the specimens of muck exhibited. He has raised sixty bushels of shelled corn to the acre with seven-eighths muck as a fer-

tilizer. Spoke of a neighbor who had better results on corn with muck and manure than with manure and superphosphate.

A farmer present would prefer soil from the roadside than muck mixed with manure.

Dr. Cutting strongly urged farmers to use some kind of absorbents in their stables.

WELLS INSTITUTE.

Dr. Cutting made some remarks upon the amount of fertilization that can be profitably applied. This can only be determined by experiment, and always should be so determined by every farmer. It will often be found that fifty pounds of dissolved bone superphosphate can be more profitably used per acre than two hundred or three hundred pounds can. Nitrogen is not often required in greater amount than any farm can supply from its stables. His remarks were listened to with great interest.

Several farmers present had received benefit from the use of wood ashes. Mr. Goodwin stated that if he could buy good wood ashes at twenty-five cents per bushel, he would prefer these to the German potash salts. Farmers here apply ashes generally in the hill, but Mr. Goodwin would apply broadcast.

E. R. Towle spoke of his experience with superphosphates, and of the necessity of every farmer trying this matter for himself on a small scale at first, and if successful, then use as wanted. The same with other fertilizers.

Dr. A. C. Grove of Wells gave a paper on "Chemical Fertilizers." This was a very plain and direct address, and should be read with interest by all.

Succeeding this paper a discussion ensued. Mr. Davis made some remarks on the use of commercial fertilizers, and of the necessity of careful trial with these in order to find whether or no they will be adapted to the soil of any farm. He would advise farmers to make and save all the manure possible on the farm, and then, if this is not sufficient for the purpose, purchase those special fertilizers that are found to be wanting in the soil; he believes that this may often be done with advantage in the improvement of our farms.

Henry Lane, member of the Board, said, I think there has been too much money paid out for commercial fertilizers in the State. Showed the analysis of many of the commercial fertilizers as found by different chemists, showing but very few anywhere in value to their commercial value. Urged the necessity of thorough tillage, a want of which oftentimes renders any fertilizer inefficient. Fertilizing men never publish the failings of any of their patrons, but their successes. Showed ninety-five trials where nitrogen was used; failed four in five times. Now is it economy for the Vermont farmer to use commercial fertilizers so far from market, crops exposed to drouth and insects which so often occur? Better look after the better condition of the soil, draining, turning up the soil to the sun and the rotation of crops. Clover once in two or three years in rotation is very beneficial. The making of good manure is one of the essentials in successful farming.

Can, by buying special foods to combine with straw, corn-stover be managed so as to pay for themselves in the manure? Save all on the farm. Then if you buy, buy only such as your soil needs.

Mr. Gates of Hartland indorsed the essay stating no class Jewed the farmers as the phosphate men.

Hon. C. H. Hulburd of Springfield spoke upon "Making the Farm More Productive." First remove the stone; if bolders, lift them from the soil and build a fire to brake them up to draw them off. Next drain by making stone drains by laying small stone and stone upon them with a three-inch square drain, carrying off all the surplus water and then you can get a good grass crop. Then plow well. The grass crop and corn crop are the crops to raise profitably, which I think is of more importance than at first thought of. After I harvest my corn, I sow grass seed, early for clover, if not *very* late. August I think the best time, with no grain crop. Another way is to cultivate well; thorough cultivation. Buy such foods as enrich our manures. Bran is rich in phosphates, what our land and stock need. He recommended plaster highly.

WAITSFIELD INSTITUTE.

Mr. Towle said it was found that farmers used fertilizers in the hill, for both potatoes and corn, to a considerable extent. In some parts of the town ashes do not appear to produce any good effect, there being a sufficient quantity of potash in the soil. Phosphoric acid seems to produce good effect. One farmer had put wheat bran in the hill for corn, along with superphosphate. The corn on the plat with the bran was the best. Last spring made some phosphate after the formula given by Dr. Cutting, treating one barrel of bone meal with three gallons of acid and adding sufficient loam to make one-half a ton, at a cost of fifteen dollars per ton. This was used with Bradley's superphosphate, same amount in the hill for corn, with no perceptable difference in the yield of product. In this case the home-made phosphate costs less than one-half that purchased, and appears to be just what is wanted.

Mr. C. E. Jones last spring tried a mixture of bone meal and wood ashes, according to the directions given by Dr. Hoskins. Used on corn, potatoes and oats, along with Bradley's, in equal values. Here the last did much the best, showing that the potash was not needed. Mr. Wilder had tried spreading manure on land in the winter and double the amount in spring, with equal results at harvest time.

A. C. Powers of Pittsford states that he used this, the formula of two hundred pounds of bone meal and fifty pounds of sulphuric acid, as given in the report of 1882, costing some eight dollars per ton, and using the same number of pounds per acre as of the Bradley's, or Quinnipiac, on corn; his corn was equally good when he put his own make, and shall make more next year.

Oscar Brown of St. Johnsbury states he used the home made from formula given by Cutting, the result being in favor of home made. Hollis S. Pierce of same place did the same with better results for home made. Alexander Stuart of same town also tried some with

similar results. Gen. Stephen Thomas of Washington used a carload of home meal, under direction of Dr. Cutting, with the best results. Further information can be obtained by writing either of these men.

WALLINGFORD INSTITUTE.

Mr. Pierce believes in high manuring for corn and for hay; did not think there was much danger of overdoing in this matter.

Mr. Childs did not hold to this opinion, and thought that land could be made too rich for some crops, as will be evidenced by their lodging down.

The chairman was decidedly averse to investing in commercial fertilizers, believing them to be frauds.

Mr. Congdon of Clarendon spoke of planting twelve acres of run-out land last season to corn with nothing but commercial fertilizers, and the result was a good crop. Where there was no fertilizers the crop was poor.

Mr. Lane thinks that on a good sod superphosphate will make the crop earlier, and that is all the benefit he receives.

Mr. Goodwin uses chemical fertilizers judiciously, and finds that in his case it pays well.

Dr. Hiram A. Cutting said the best means of fertilizing was of the greatest importance to the farmer, and it had become almost settled that nitrogen was not needed as much as many had supposed, and the recent report of the agricultural department at Washington had confirmed his previous teachings that a large amount of soluble phosphoric acid was not needed, and they admitted also that the reverted was considered by many of equal if not greater value than the soluble. Hence science was coming to substantiate the experiments he had talked about. It was always safe to trust the plant, for it did not theorize, while some chemists did.

HAY CROP.

BRADFORD INSTITUTE.

M. W. Davis, member of the board, spoke an hour upon "Grass," its cultivation and utilization; urging a better care of their pastures, discreetly selecting from the standpoint of adaptation such as is best to grow up to forest, such to pasture and such to meadow; saying to bushes and trees (except for shade) "thus far shalt thou come and no farther;" applying proper fertilization and change of stock as will clothe the barren hillside with grass. Spoke of underdraining and top dressing; urged the growing of clover as the important factor in agriculture, not only as one of the best forage crops, but a pulverizer and a fertilizer in the soil almost unsurpassed; saying that many sections if they should abandon this plant would meet with a revolution in agriculture. Urged the farmers to make grass the "central idea"

of their vocation and all other efforts subsidiary. For the county that neglects grass deteriorates, depopulates, resulting in the multiplying of abandoned homes and forest usurpation.

ENOSBURGH INSTITUTE.

In the afternoon, Rev. J. H. Winslow of Lunenburgh gave an address on "Experimental Farm Education." He remarked that the time was when education or brains were not considered as a necessary part of a farmer's outfit. But now things are changed, and the farmer is, or should be, the best educated man in the community. Farming is to-day in reality a science, and requires as much or more thought than any other vocation. If the farmer by actual experiment finds out what he can do and acts upon it, he can even make farming more profitable than investments in banks or stocks. Thus, with thought before work he can make profitable investments upon the green hills of Vermont. A few years ago he lived in the Connecticut River valley, and two meadow farms were divided by a board fence. No. 1 cuts three tons to the acre; No. 2, one-half ton. No. 1 rejoiced in good crops; No. 2 complained of drought. No. 1 farm supported its owner, and had for three generations; No. 2, just as good if it was farmed as well, necessitated that the owner watch nights for the railroad company to gain subsistence for his family. In Lunenburgh, where he now lives, two fields are divided by a line fence. One field cuts three and two-thirds tons per acre; the other about one-half ton. Thus it is in life; success and failure is often only divided but by a line fence.

MONTGOMERY INSTITUTE.

Mr. Davis, member of the board, then gave a lecture on "Our Grass Product."

A discussion followed. Mr. Davis stated that he uses land plaster liberally on his meadows, sowing early in spring and then again after the crop of hay is removed. He stated that clover often winter-kills. This is the case on some farms in Montgomery and elsewhere. Mr. Goodwin asked if the farmers here raise red-top. One answered in the affirmative. He advised giving more attention to this grass by farmers, as helping to give a better quality of hay. It lasts a long time in the sod. Would cut grass early for hay and does not like to mow in the morning until the dew is off; neither to dry too much. Calculated to seed quite heavily to grass.

Silas Hopkins is partial to clover as a crop for hay and as a second crop to feed green to the cows.

Heman Hopkins, Jr., spoke of sowing redtop along with timothy and red clover, and thinks it improves the quality of the hay.

Mr. Comings thinks there is greater loss from leaving hay out too long in drying than by putting in the barn when quite green.

The Secretary gave some of his experience in the production of grass for hay. Thinks many dry too much.

WHITE RIVER JUNCTION INSTITUTE.

M. W. Davis of Westminster led the discussion with an address upon "The Grass Question." He set forth the character and number of our grasses—considered herdsgrass the best of all, and clover did not botanically belong to the grass family; he considered it next to herdsgrass for hay.

Homer Vail of Pomfret top dresses land for several years, but thinks it best to turn over and re-seed. Has never failed of getting a good catch sowing in the fall; should sow in August.

Mr. Ruggles of Hartland sows twelve pounds clover seed and nine pounds herdsgrass seed to the acre; which is one clover seed to two square inches and three herdsgrass seeds to a square inch, which he calls best. Finds by experiment that the best seed he could get contains over 200,000 foul seeds to the acre.

C. B. Ballard of Hartford would always plow and restock, never top dress. Would plow in August and restock at once without grain, and never fails to get a good turf. Can, however, stock with wheat in the spring with success.

The president remarked that in his experience top dressing was the best, and he had increased his grass crop very much. Took a farm that did not cut a ton of good hay, and now had not a ton of poor. His grass crop was a satisfactory one, and he believed in top dressing.

Dr. Cutting advocated top dressing in winter; gave statements and results of experiments.

PASTURES.

BENNINGTON INSTITUTE.

The first subject taken up was the "Improvement of Pastures," by E. R. Towle. He was followed with remarks by the farmers present.

Mr. Bottom stated that his pastures are deteriorating and need attention. The chairman stated that his pasture had been improved by sowing on plaster and ashes, bringing in the white clover readily.

Mr. Rockwood stated that brakes are not in the pastures here to any great extent. Top dressing his pastures with stable manure, superphosphates and ashes, produces excellent results, and he does not need to plow. The land is a side-hill, and is in part clay. One farmer said in relation to seeding that he would sow timothy, red clover and red top. Would sow red top on any kind of soil, either high or low, as he considered it the best grass we have.

Mr. Davis made some remarks on the subject, in which he regretted the destruction of our forests, being of the opinion it will act unfavorable on the agricultural production of our country.

BRADFORD INSTITUTE.

E. R. Towle read a paper on the "Fertilization of Pastures," which was well received and was followed by an interesting and profitable discussion participated in by A. McLane of Fairlee and others. The

gentleman said that most of the pastures in this part of the State cannot be plowed; on such fields he considers the only possible method of renovation to be by the aid of sheep. Bushes grow largely and are hard to subdue; these can be cut with good advantage in August and September. Sheep will improve pastures; their droppings are in a more available form than those from cattle; gave an instance of this character that was to the point. The soil here is of slate formation and very susceptible to the drouth. Spoke of a farmer who has a meadow that has not been plowed for thirty-five years, and produces excellent crops of hay; sheep are pastured on this after haying, and their droppings are the only means of fertilization used.

Mr. John Smith of Newbury stated that large tracts of pasture lands in Orange county are become almost worthless. Is of opinion that where they can be plowed they can be improved by cultivation and fertilization. Will let a portion of his own grow up again to wood. Would not plow natural grass lands. Maple and pine grow on these poor pastures naturally.

E. C. Redington of Bradford, although not a farmer, made some excellent remarks.

Mr. O. B. Rodgers of Bradford spoke of purchasing a worn out pasture of seven acres and put on seventy-five sheep; this killed out the fine grass and it has since become much improved. Spoke of plowing a pasture to advantage, and was in favor of grazing with sheep.

Dr. Cutting spoke in relation to the benefit of pasturing lands with sheep; that it is due largely to the condition in which the droppings are left or distributed. If farmers would apply a small amount of fertilizers to their pastures oftener, the result would undoubtedly be better than a large amount at one time. Slate makes a good soil, containing potash in considerable quantities. Believes that plaster will work well on dry soils, and especially those of a slaty character. Does not think that nitrogenous fertilizers are needed to any great extent on pastures, and when combined with purchased fertilizers will usually be lost. The phosphoric acid and potash very likely are needed, either singly or in combination, on most pastures. Would advise farmers to purchase a superphosphate with three per cent. of soluble phosphoric acid, five of reverted and ten of insoluble, and of this put on no more than fifty pounds per acre at a single application. If this small amount cannot be readily sowed, mix with sand, sawdust or some similar material to increase the bulk sufficient.

Mr. Johnson Golding of Bradford has a poor pasture that he is trying to improve a little at a time, and uses salt and ashes as a fertilizer with good advantage on wheat. Where plaster was applied, five hundred pounds to the acre, superphosphate did not do any better. On another portion ashes did exceedingly well. Planted corn with nothing but a handful of hen manure in a hill; raised thirty-four bushels of shelled corn on half an acre.

Dr. Cutting is of opinion that a small amount of salt may be used advantageously on dry land.

FAIRFAX INSTITUTE.

Mr. Morse of Cambridge gave some valuable experience in the renovation of pastures. Where they can be plowed he considers this is the best method to pursue. Has destroyed brakes with salt. Douglas Buck kills brakes by salting stock on spots covered with them. Would not turn cattle on to a newly seeded pasture for a year or two after stocking down.

Mr. Davis would advise the use of more clover in the improvement of our farms.

PASSUMPSIC INSTITUTE.

Mr. J. B. Foster stated that the pastures of Caledonia County are sadly deteriorating. They were formerly cropped excessively and without manure—a very bad practice. The pastures of Waterford, which is of a slaty soil and cannot be plowed, have not run out so fast. Cattle seem addicted to gnawing old bones and pieces of boards and leather. This indicates a want of phosphates in the soil. He feeds shorts to his cows the year round and they are free from this propensity of gnawing old bones. Little attempt has yet been made to improve the pastures. Last year took a piece of poor pasture land and sowed thereon a barrel of superphosphate to the acre and a good quantity of grass seed. This produced an excellent crop of grass, and he feels encouraged to further efforts in this direction.

Mr. Goodwin said that it was the phosphoric acid that the cattle required, and this is supplied in the bones or superphosphate. The farmers stated that on one side of the river ashes produce excellent results, while on the other side, where the soil is of a slaty character, they produce little effect, there evidently being a sufficient amount in the land. He would advise sowing a superphosphate of lime on some of our pastures that cannot be plowed. He advocated the practice of feeding shorts or bran to stock.

Mr. Foster endorsed the idea of raising wood and timber on poor, rough pastures as the best practice.

Mr. Harvey spoke of lime being in one spring of water, and another a short distance away appears to contain none. He says that farmers graze their pastures too close and injure them in this way. Advised the plowing in of clover for improving the land.

Mr. Warden spoke of improving an old pasture by putting on a compost of hard wood muck and ashes, making a great improvement. It was composed largely of leaves. He advised the using of superphosphate on pastures.

Rev. Mr. Winslow of Lunenburgh spoke of killing weeds by persistent mowing and improving a pasture by top dressing with stable manure.

Mr. Goodwin stated that when wood ashes cannot be obtained, muriate of potash may be used as a substitute. He spoke of the importance of farmers making experiments for themselves with different fertilizers in order to find out what was most needed.

Mr. Foster spoke of the scarcity of help. If more were to be had a great saving might be effected in the gathering up of the wastes of the farm.

Rev. Mr. Alger spoke of the importance of more careful experiments on the farm, the weighing or measuring of the product instead of guessing as is too often done.

Mr. Harvey advised better farming on small areas instead of buying more land.

PUTNEY INSTITUTE.

Mr. Courser finds that cattle deplete a pasture and sheep improve it. Grubs work badly in places. He finds that frequent changes from cattle to sheep helps the pasture. Sheep will destroy briers and bushes.

Mr. Newton thought that some pastures would hardly pay for improving. Perhaps such might be devoted to a growth of wood.

Mr. Pember spoke of wild carrot as a great pest on his farm, and was anxious to know of some method of destroying it. He is also troubled with the running blackberry vine. He was advised to plow and pull out the roots as the best method for destroying them. Other farmers are troubled with the same vine.

Mr. Cutting stated that the brakes are the worst enemy in the pastures hereabouts. He finds brake sods hard to subdue. Pastures here cannot well be plowed, and are being turned over for the grazing of sheep.

Mr. Davis endorsed the idea of pasturing with sheep, and thinks it might be made profitable. A farmer spoke of a neighbor who has a very nice old pasture which has been kept in good condition by the yearly application of a small quantity of ashes and spreading the droppings from the stock. Can kill brakes by plowing and manuring heavily.

Mr. Courser finds that manure spread on will not kill brakes but make them grow much larger. He got rid of them by plowing and hoeing two years, one with potatoes and the other with corn.

Mr. Puffer was of the opinion that the pastures of Putney would have been better to-day if more stock had been kept, and by feeding some extra late in the season, if necessary.

WOLCOTT INSTITUTE.

Mr. Slayton stated that the moss in the pastures is worse to contend with than brakes. Evergreen trees injure a pasture.

Mr. Dwinell said that ashes applied to moss pastures had produced good effects. This is well worth trying by farmers troubled in this way. Hard hack does not grow here to any extent.

Rev. Mr. Morse urged the farmers to give their experience on this subject. Spoke of a newly cleared pasture of hemlock land soon becoming covered with weeds and mosses. He resorts to plowing small pieces at a time, sowing with rye or some other grain, and seeded with about double the usual amount of grass. Did not fence in, but let the stock run on it at will. In this way the pasture was greatly improved. A farmer has killed brakes by repeated mowing.

Mr. Whitney finds that it requires three years to subdue moss knolls and get the land into grass. Improving pastures by the use of swine was spoken of as advisable in certain cases where there were brakes.

POTATO CROP.

ENOSBURGH INSTITUTE.

Rev. J. H. Winslow said in selection of seed there should be the greatest care. One man plants little potatoes year after year, and the result is as he plants; another, like Hon. J. Brooks of Lunenburgh, who originated the Brooks' seedlings from his selection, raised about four hundred bushels from one-half acre. He sold the same for four dollars a bushel, and many a farmer felt too poor to buy, while those that did rejoiced in over five hundred bushels per acre as the result of that yield.

MANCHESTER INSTITUTE.

A paper on "Potato Culture" was read by Mr. E. R. Towle of Franklin. Mr. George Smith of Manchester read a paper on "What We Want is Practical Experience." He raised the early Vermont potatoes which he regards as one of the best varieties. Used dissolved bone meal as a fertilizer on nine rows, barnyard manure on nine rows; one-fourth kainit and three-fourth dissolved bone on nine rows. The barnyard manure was well rotted and applied a shovelful in a hill. There was no difference between the barnyard manure and the dissolved bone in the crop produced. The rows manured with kainit and dissolved bone gave a larger yield and better potatoes.

Question.—How did you know about the yield? Did you weigh or measure them?

I didn't weigh or measure: I just guessed at it. On a piece where the dissolved bone was used, applied directly to the seed potatoes, the crop was so poor that I didn't dig the potatoes.

Mr. E. A. Smith of Danby has been putting forest leaves in the furrow with his potatoes, and as he has had no rot in that time regards this as a preventative.

L. P. Smith of Trumansburgh, N. Y., said Mr. T. B. Tenny of Cleveland, O., one of the best potato raisers in this country, says he would not take $1000 over the market price of his seed potatoes. He could not afford to do it. His seed is obtained by selection at the time of planting, and this course has been followed for a number of years until he thinks he has seed with a pedigree, and has established in it a sort of prepotency or power of reproducing its good qualities which ordinary potatoes do not have.

There are those, however, who seem to have no difficulty in raising good potatoes from less than medium sized seed, and who thinks this plan is equally good. The best way, if there is one, has not been determined as yet.

Mr. Winslow of Pittsford has used an arrangement for sprinkling his potatoes with Paris green which has some merit. It is simply two tubes in the shape of a T, the stem to slip on the watering pot, and the top perforated for a sprinkler.

Mr. Schuyler had tried bone dust on potatoes, and it didn't do him any good.

One farmer had tried plaster on clay loam. Some seasons it does well, and at others no effect can be seen.

Mr. Purdy has produced one hundred and seventy-five bushels of potatoes on three-fourths of an acre.

Several have had bad results from the use of ashes.

One farmer plowed clover sod and put ashes in the hill with excellent results. Always before had had scabby potatoes when he applied ashes on old soil.

Another had good success with old pasture and phosphate; it gave a good crop. Had good crop also with phosphate in hill for corn.

Mr. Baldwin formerly put ashes on his potatoes before covering; but three years ago he discarded the ashes, and has had no trouble with scabby potatoes since.

Mr. Eddy had bad luck with potatoes where ashes were applied directly. He put dirt over them first and then ashes, and the result was good. In one case he manured highly with sheep manure, unrotted; there would be fifty potatoes in a hill, and not one of them bigger than a walnut. There was not an eating potato in the lot. Where he put in muck with a little manure he had fine potatoes.

Mr. Hubbard had one hundred and twenty-seven bushels of sound corn and ten bushels of soft corn on one and one-quarter acres, with no artificial manures.

Mr. Purdy had twenty-six bushels of large potatoes from six quarts of early rose, cut one eye to the hill.

Mr. Bottom would not use salt on potatoes to prevent scab.

PITTSFORD INSTITUTE.

Mr. Winslow of Chittenden being called upon, gave his experience in raising potatoes. He raises from twelve hundred to two thousand bushels each year, raising on an average two hundred to two hundred and fifty bushels per acre. He is very careful in the selection of seed, selecting in the fall, and rejecting those hills which have made an imperfect growth; always cuts the seed, putting one piece in the hill, and uses about eight bushels per acre.

F. D. Douglass said he raised potatoes as he did corn, without using the hoe at all except at the ends where the team turns around; using the Thomas smoothing harrow as soon as the weeds begin to make their appearance, and following with the cultivator and horse hoe. He also extended his remarks enthusiastically, advocating getting out of the old system of farming, and adopting more machinery, doing the same or more work with less labor and reaping much larger profits.

WASHINGTON INSTITUTE.

Gen. Stephen Thomas asked "How deep should potatoes be planted, and should they be cultivated with a flat surface or hilled up?" Mr. Pember gave the method in vogue in his section of the State as being the flat or shallow planting system, and the cultivation to be without hilling. This he said had given the best results in the western part of the State and in New York. Mr.

Davis believed in planting in a furrow and hilling, as did General Thomas, that style giving better results with them than flat planting. This was partially explained by the fact that in the section to which Mr. Pember referred the soil was moist, while with Gen. Thomas and Mr. Davis the land was dry.

The last query was, "What kind of potatoes are best to plant?" which was answered by saying it depended on what kind the market demanded. "Snow Flake" and "Beauty of Hebron" for the table, "Early Rose" for the market.

What causes scab in potatoes? Sometimes it seems to be an excess of potash in the soil, at others it is not caused by this, and it is difficult to give any answer which would be of general application. Dr. Cutting remarked that many said their potatoes were always scabby when they used sawdust for bedding and used that manure for potatoes, and that chip dirt also gave the same results. He stated that his opinion was that this was not the only cause. Should use salt to prevent it; about two bushels to the acre. It did not always have the desired effect, but he believed it a help at least. Broke up ground or a soil made light by strawy manure or leaves was called the best for good potatoes.

POULTRY.

ESSEX INSTITUTE.

Mr. Edwin Andrews first spoke briefly upon the subject of "Poultry." He has been in the business for thirty years, and has had considerable experience in that time. Is satisfied that more has been realized in Vermont the past season from eggs and poultry than from cheese or wool. Thinks more can be realized from the capital invested in this industry than any other. No other branch of farming is so much neglected as this, yet is glad to note improvement in this direction. Some farmers raise a large number of turkeys, and when well taken care of are found profitable; but it is with this industry as with all others, good management will always command success. Referred to the importance of preparing poultry in the best manner for market, as much depends upon this. For winter laying feeds warm food, with corn, buckwheat, etc. Give a variety of food and do not keep too fat, as the production of eggs will in this case be lessened in consequence.

FERRISBURGH INSTITUTE.

Mr. Carpenter of Charlotte spoke of the advantages of poultry. Said it was a common custom to feed milk to hogs that would not sell for over four cents per pound, when it could be used in feeding poultry that would bring eighteen or twenty cents per pound. He had been very successful the past year in feeding milk to chickens. Thinks he can make as many pounds of poultry as of pork with his milk. Feeds curd from milk with wheat bran and oats mixed, and fed raw.

Winters sixty-five hens, and sold as their product in eggs $71.62, chickens $490.38, and had eighty-eight hens now on hand. He made chickens weigh from two to three pounds at three months, average weight three and one-half pounds. Fed to produce this result in addition to his sour milk about two hundred dollars worth of all other food. Judge N. J. Allen spoke in high terms of the hen as a source of profit, and the egg the most economical as well as the best food.

PUTNEY INSTITUTE.

The following poultry items were handed in by Mr. H. G. Hicks, blacksmith, and shows what may be done on a small scale with hens: In the spring of 1882 had forty-six hens, white and brown Leghorns, mixed. From March first to October first, seven months, obtained 4880 eggs, or 407 dozen, lacking four eggs, which sold for $84.54; forty-seven chicks which sold for $58.75; and manure for $6.06; making a total of $149.29. Cost of keeping was $62.54; making a profit of $86.75. Fed corn in the morning and oats at night. Run in small yards, and care next to nothing. Has wintered in a warm room, adjoining his shop, sixteen brown Leghorn pullets, hatched last of May. Since December 9, they have laid 564 eggs, sold at thirty cents per dozen, equal to fourteen dollars. Fed in morning a warm mash composed of ground oats, corn and rye, in the following proportions: ten bushels oats, three bushels corn and two and one-half bushels rye. At noon give a small quantity of whole wheat and meat, and bone obtained from beef heads broken up fine. Night, corn and oats. Supply with oyster shells, gravel and ashes; give warmed water. Whole cost of feed up to date, $9.50; balance in favor of pullets, $4.50. A true account of everything has been kept. While on most farms the hens lay few or no eggs, running their owners in debt for their keeping, this little flock has not only paid the entire cost of keeping but afforded a considerable profit. But it may be fair to state that the owner takes great interest in his business; that everything is kept in the best of order, and probably on this depends much of his success. The lesson to be derived from this is obvious, "whatever is worth doing at all is worth doing well."

SHEEP.

GUILDHALL INSTITUTE.

Hon. A. R. Boyce of Granby was introduced. He made some excellent remarks on the general subject of "Agriculture." Does not find that in this part of the State that Merino sheep thrive nearly as well as Mr. Lane stated that they do in Addison county. Does not know the reason for the failure, and would be glad to find it out. The coarse wool breeds are kept and the lambs mostly sold at six months old. Good lambs at this age will bring from $4.50 to $5 per head. He is of the opinion that the most profit will be obtained from them at this age instead of keeping until older.

Mr. Lane stated that from what he knows of the soil of Essex county he would not advise the farmers to attempt to breed and keep Merino sheep, as he thinks they would not do as well as in our own part of the State. He would, however, advise farmers to keep some of the coarse wool breeds, believing this would be profitable. Sell when it will be the most profitable, all things considered. Believes that more can be made in fattening sheep than young cattle. Farmers in his part of the State are improving. This was not the case at one time, but more attention is paid to keeping up the fertility than at the time mentioned. This may be the case in Essex county.

Mr. Bruce is of the opinion that a full blood Leicester, Cotswold or Southdowns will not do as well here as the natives or grades. The soil here is gravelly and sandy loam, with some clay.

Mr. Lane stated that Merino sheep would not do well on the lighter kinds of soils. He finds that pure blood Leicester or Cotswold will not fatten as readily as a cross with the Merino.

Dr. Cutting is of the opinion that the atmosphere, the extremes of weather, has something to do with the success of keeping Merino sheep here. Soil, water, etc., may also have something to do with it.

Mr. Davis spoke of the treatment received by sheep at the hands of their owners in Addison county as having much to do with their success, aided by natural resources. He told the farmers to raise coarse wool lambs here, and the farmers in his part of the State would be glad to buy them at a good price and fit them for the market.

OTHER INSTITUTES.

Much has been said about Merino sheep, but we believe Mr. Lane's excellent addresses on the sheep cover the ground very well, and what we might report would be repetition, so refer all to his articles on the sheep.

SUGAR MAKING.

CHELSEA INSTITUTE.

Maple Sugar was first taken up by E. R. Towle, and followed with an interesting discussion that occupied the remainder of the evening.

From this it appeared that a large amount of sugar is manufactured in this part of Orange county. It is put up in a variety of styles to suit customers, and found to be a profitable industry.

GUILDHALL INSTITUTE.

E. R. Towle of the board commenced the exercises by a short address on "Sugar Making in Vermont," a subject that elicited considerable discussion, in which the farmers appeared particularly interested. Not a very large amount of sugar is made in the town of Guildhall, the trees not producing a very large amount of sap. Tin and wooden buckets are used, wooden spouts and pans exclusively for boiling.

It is found that the nitre or malate of lime varies greatly in different seasons.

Mr. Boyce would prefer to sell maple syrup at $1 per gallon than to make into sugar.

Dr. Cutting made some interesting remarks in relation to the production of sap, exceptionally large yields of single trees and entire orchards, etc. From experiments, he is of the opinion that if sugar orchards were fertilized with wood ashes, or perhaps land plaster, would be beneficial. The birch tree will produce crude glucose, but not common sugar. Some maple trees will not produce sap, which is very difficult to account for. He does not believe that driving nails into trees injures them to any great extent, neither metallic spouts. Thinks from experiment that the injury results from pulling the nail and also the spout before the sap is fully done running, and that the sap starts out and sours, the acidity killing the tree. Acid is death to any kind of vegetation where it touches. In relation to tapping at different heights from the ground, he found last spring, by the closest experiments, that trees tapped nine inches from the ground produced double the amount of sap that was obtained from tapping three feet higher, while the sap was considerable sweeter. A farmer concurred with this experiment. Spoke of the importance of evaporating sap to syrup and this to sugar very fast, as in this way time and fuel will be saved, and a much lighter colored and better flavored product will be secured. The sap in pans should be quite shallow, not more than one inch in depth, if the most rapid evaporation is desired. The farmer who has a good sugar place should attend to it as carefully as any other portion of the farm. Not many other kinds of trees should be allowed to grow in a sugar orchard.

Mr. Boyce is of the opinion that the orchards that commence running first are the most profitable.

Mr. Grout stated that he had made twelve hundred pounds of sugar from about one hundred and seventy-five trees, which was a very fine yield.

LUNENBURGH INSTITUTE.

Mr. Chester Thomas, being called upon, made some remarks on "Sugar Making." He would have thrifty trees and would tap with a one-half rasp bit, two and one-half inches deep; uses a wooden spout only reaching through the bark, and catches in nice clean buckets. Must avoid sourness in any of the utensils. Gathers often and clean, and when the buckets get sour washes them. Boils in pans set on an arch twelve feet long; pans twenty-two inches wide. In boiling have the sap shallow in the pans so as to evaporate fast. Taps two hundred trees. Having trouble with common holders, has had one made of tin holding one hundred pailfuls, and likes it well. Intends to draw the sap in a tin tub. Makes a quantity of syrup, and boils down very quickly. Would have it weigh eleven pounds to the gallon. Puts most of his sugar in twenty-five pound cans for local demand. Has made six hundred pounds from one hundred trees. Cannot nearly meet the demand for his sugar and syrup at good prices. Likes a

tin bucket the commencement of the season, but late a bad flavor is imparted to the sugar. Would not use cedar buckets or any wooden buckets after they have become old or unfit for the purpose.

STOWE INSTITUTE.

"Sugar Making" was taken up by E. R. Towle. At its close Mr. Fuller gave his experience in this industry. Taps about nine hundred trees, mostly old growth, located on low, hard, stony ground. Uses tin buckets; prefers the Post spout. Is careful to keep everything clean and in working order. Uses an evaporator, strains the sap thoroughly, boils down rapidly, and if time permit sugar off at once. On drawing off the syrup, there is usually much of the malate of lime. If allowed to stand for a while before sugaring off there is no sediment in the bottom of the vessel. Makes mostly into sugar, puts in thirty pound tubs and markets mostly in Illinois, and is not able to supply the demand. He made thirty-six hundred pounds in one season. A good deal of syrup is made for the market by farmers in this section.

Mr. Gale prefers wood packages to tin, as he thought that the sugar would keep best.

Dr. Cutting followed in some interesting remarks. He spoke in favor of the Post spouts, and thought the objections raised against them, as likely to injure the trees, as not really the case. Is of the opinion that where the trees are found decaying about the place of tapping is due to the action of the sour, acid sap that runs last after the spouts are withdrawn. The remedy would be either to plug the the hole tightly, or else let the spouts remain until the sap has entirely ceased running. He emphasized the idea of gathering the sap as soon as possible after running and boiling down rapidly to the consistency of syrup or sugar, as the quality will in this way be superior, with a freedom from nitre or malate of lime. The sap should be very shallow in the pans to facilitate rapid evaporation and secure a better quality of sugar.

REPORT

OF THE

VERMONT DAIRYMEN'S ASSOCIATION

For the Years 1883 and 1884.

OFFICERS—1883.

President—JOHN B. MEAD, of Randolph.
Vice Presidents—F. D. DOUGLASS, of Whiting, AARON LOVELAND, of Norwich, L. H. TALCOTT, of Williston.
Secretary—O. M. TINKHAM, of North Pomfret.
Treasurer—H. W. VAIL, of North Pomfret.
Auditor—C. C. PIERCE, of Clarendon.

OFFICERS—1884.

President—JOHN B. MEAD, of Randolph.
Vice Presidents—AARON LOVELAND, of Norwich, F. D. DOUGLASS, of Whiting, L. H. TALCOTT, of Williston.
Secretary—O. M. TINKHAM, of North Pomfret.
Treasurer—H. W. VAIL, of North Pomfret.
Auditor—GEO. B. WILLIAMS, of Walpole, N. H.

The fourteenth annual meeting was held at Burlington, January 17, 18 and 19, 1883, and the fifteenth at St. Johnsbury, January 23, 24 and 25, 1884.

The Board of Agriculture attended and took part in these meetings, and voted to publish this report in connection with our own.

The report was respectfully submitted by O. M. TINKHAM, Secretary of Dairymen's Association.

BURLINGTON MEETING.

The fourteenth annual winter meeting of this association was held in the City Hall in Burlington, the president, Hon. John B. Mead of Randolph, in the chair.

On opening the meeting, Col. Mead said: The work of the association in Vermont confirms the belief that the founders of it builded wiser than they knew. I am well assured that, since its origin fourteen years ago, this association has done an incalculable amount of good to the material prosperity of Vermont. And it has not been alone in its work. Associations of the same kind in other States have joined with it in advancing their common interests by the presence in its meetings of representative men in the great industries belonging to and connected with that of dairying, many of whom, I am happy to announce, we have here with us at this time. I think I may safely say, although I have not seen the tabulated census of 1880—still, from conversing with good judges in the matter, I think I may say, that since the advent of this association the average number of pounds of butter yearly produced has increased at least fifty pounds per dairy; and there are a large number of dairies in which the increase is very much larger—from one hundred fifty to three hundred pounds. And not only this, but all interests subsidiary to dairying have been well considered by the association, and improvements have been made in them. There is the great question of feeding. Ensilage reports have not been few. But much is yet to be learned upon this subject, and it will be discussed at the present meeting. What we want to arrive at is facts. If it be true, as some say, that the feed may be put into pits and all expense covered at one dollar a ton, then the question of farming in Vermont is solved for all the future. Other great questions will be brought before us. I congratulate you that the interest in these departments is all the while increasing. By cheese and butter improvement the interest of every farmer in Vermont is enhanced, so that our work is not only vast and profitable, but interesting and fruitful. There is much still to be brought out that will be of advantage to us in our daily work. The State of Vermont has become settled in the conviction that something should be done to encourage these industries upon which her prosperity so largely depends. We are not alone in our work, but every organization of the kind in the State combines with us and encourages us.

Following Col. Mead's address, was a lively discussion on the best method of packing butter, and also, whether there is any preparation which will prevent its turning rancid, or restore it after it has turned, concluding that there was not.

The afternoon session was opened by an address by Prof. A. P. Grinnell of the medical department of the University, on

"MILK IN HEALTH AND DISEASE."

He spoke upon milk, from a point of view strictly scientific. There is, he said, no substitute for milk. Upon it depends the development of men and women and many animals. One-fifth of all the people

that are born die within the first year of their life and one-third within the first five years. Much of this mortality is due, not to Providence, to whom we are apt to attribute all ills, but to ourselves. We often see infants fed on corn starch, farina and other substances, all containing starch, which can never be digested by the infantile stomach. A child at teething time has the power of manufacturing a substance in its saliva which can convert starch into glucose. Prior to that time it cannot digest starchy matter, and feeding it upon such substances leads to disease and death. Milk is the only proper food for young infants, and all the preparations are inferior to cow's milk. Mother's milk is of course the best and most natural food, and next to it comes cow's milk. Dr. Grinnell then described the physiological process of the digestion of food at some length, showing the evils arising from feeding infants with starchy substances, and continued: Milk, whether it contains fat itself or not, tends to make fat—to make adipose matter in the human system. The lightest milk is not the poorest milk, necessarily. It may and often does contain a larger quantity of fatty matter than milk of a higher specific gravity. It is simply lacking in saline matter. Milk contains in itself everything that is necessary to support life. It is believed that a man can live upon milk alone. A late distinguished physician, well known here, lived for years upon only milk and rice. But such food will not of course do for a man who has much physical labor to perform. Every man at almost every meal eats more than he requires, and more than he ought to eat. But kindly nature has furnished means for obviating the consequences of excess.

There is not so much dissimularity between cow's milk and woman's milk as has been supposed. In woman's milk eighty-nine parts out of every hundred are water; in cow's milk, eighty-six; and in other respects there is a close similiarity. The speaker then gave an analysis of the milk of different animals, and said that as a substitute for mother's milk cow's milk was the only desirable thing. Some people think that they can not eat milk. But he claimed that there is not one person in ten thousand who can not live wholly upon milk. The milk diet has come to be considered something of great importance by the medical profession. There is one hospital in Philadelphia devoted exclusively to the milk diet. Patients are fed two ounces of milk every two hours at the outset, and are finally given a gallon every twenty-four hours. This, with message and electricity, works almost miracles in the way of curing the sick. Milk is now largely used in febrile diseases. In typhoid fevers many physicians make their patients live entirely on milk.

Dr. Grinnell then traced the course of milk in the passage through the stomach, showing the changes it undergoes, and continued: The fat or cream of milk contains six kinds of fats, margarine leading in quantity, three fixed oils and three volatile. It is these that give butter its flavor—a flavor which no art can imitate. Every person who needs fat gets it in butter, and he gets it in oleomargarine. This latter is a very useful article. It contains everything that makes butter except the flavor. But even oleomargarine is adulterated. The

manufacturers put cotton-seed oil into it. But if pure, it is a perfect substitute for butter, as far as its component elements are concerned. Of course it is not really butter and never can be, and if I were a farmer I would never be afraid of any dangers arising from its competition.

Skim milk cheese, the speaker said, is an exceedingly useful article of food, and ought to be in more general use. The only thing it lacks is fat, and most of us eat too much fat anyway. Our ordinary cheese is good for a meal in itself, but it is quite indigestible when eaten with anything else. In skimmed milk cheese there is much fat, and the nitrogenous substances and the sugars still remain in it. There are only eighty-eight parts of water in it, while in the best milk there are eighty-six parts. Buttermilk contains a large quantity of nutritious matter, and ought to be more largely used. As a drink it is of much value, and in febrile disease it is especially useful. Diabetes has become a very prevalent disease here in Vermont. Let its victim live on skim milk or butter milk and he will lose his fat, increase his muscle and prolong his life for months, and perhaps for years. In the tenement houses of the great cities the children are fed upon tea diluted with skim milk. Tea is simply a stimulant and contains no food material whatever. Were the children fed upon skim milk or buttermilk they would live, instead of dying off by hundreds.

The next speaker was Mr. G. W. Simpson of Boston, who spoke upon the subject of

CREAMERIES.

The creamery system, he said, is the true system. You must have the facilities to begin with. You have the facilities, but you have sold your butter at too high prices to think of selling it to the creameries. The first thing needful is milk of the right quality. With that, the creamery business can be made a success wherever farmers will sell their milk at a reasonable price. But the experience is that farmers compete to see who can sell the poorest milk. I think that in every locality there should be some kind of an association to look after the farmers. Then if a man waters his milk or gives poor food he will be found out and condemned. At present if the creamery man finds out that such things are being done, he doesn't get much sympathy from the farmers. The milk-watering, etc., isn't condemned as it ought to be. If this State would turn its attention to raising milk for creameries I doubt if they could do anything better. It would not be profitable, probably, to try to run creameries here in the winter. But in the summer they could be made very successful. In my personal experience with a creamery at Monticello, Iowa, the farmers have paid off their mortgages and have become prosperous, simply from selling their milk to the creameries. To make Vermont a creamery State its farmers must have a system of their own, and must stand by themselves and the creamery man. Co-operative creameries have not proved a success, because they did not have the continual personal supervision that other creameries have.

As to practical matters, it is absolutely necessary that the milk be delivered at the creamery punctually and early. As to price, there is a limit to the price of butter. Oleomargarine has a new sweet flavor which butter that is held too long doesn't have. In the fall the farmers begin to drop out, just when the creamery man has a chance for making a little money. If Vermont is to become a creamery State, the farmers must treat the creamery people with justice. If the business is once established in this State, Vermont would never go back to the old system. Poor butter is what brought oleomargarine into the market. If we make good butter, we need not be a bit afraid of oleomargarine. There is a limit of price which the public will not go beyond. When we pay forty cents for butter here, the retail customer has to pay a higher price, and he doesn't like it. The least number of cows with which a creamery ought to be started is three hundred. If you can sell your butter at high prices all through the season, of course you don't need the creamery system. In the west we skim the milk and return the milk to the farmers. The farmers deliver their milk, in the first place, twice a day. To make first-class butter requires the very closest attention; and hence it does not pay for a farmer to make his own butter unless he has a large dairy. If the farmers could sell their milk to creameries they would get just as much for it, or a little more, and relieve themselves of a great deal of trouble. We figure four pounds of butter to every one hundred pounds of milk. The margin for running the creamery and marketing expenses is four cents a pound. Mr. Simpson was frequently interrupted by questions from various gentlemen in the audience, the answers to which were prompt and definite.

Hon. Austin Belknap, of Boston, president of the Butter, Cheese and Egg Association, addressed the association on "Making and keeping butter." He said—I do not claim to possess scientific knowledge on the subject of butter and cheese. I look upon butter making as one of the fine arts. No man or woman can make good butter without the sensitiveness of good taste to recognize what constitutes the excellencies of butter. The ordinary farmer hardly ever reaches this topmost round in the manufacture of butter, and for various reasons. Sometimes he has a poor farm. There can be no such thing as good milk without good feed. Sometimes he does not succeed because he lacks skill. Again, a good many farmers have not the means, the proper furniture, for making good butter. But oftenest of all, perhaps, the reason why the ordinary farmer does not succeed in making marketable butter is because he gets accustomed to the flavor of the butter which his wife makes, and adopts that as his style of excellence. A's butter comes to me, and I sell it for twenty or twenty-two cents per pound; B's higher, C's higher still, and D's brings thirty cents regularly. It is fair to assume that one year after another these dairies will average about the same in price per pound. Again, I have been in dairies where the flavor and working of the butter was excellent, but it goes down into a cellar, and is placed on a platform, and stands there for several weeks before it goes to market. There is a hole in the cellar wall at which the air enters constantly. The

temperature keeps changing, and the butter gets tainted. Every man is a speculator, practically, to the extent of his means. Now, if farmers make their butter and keep it where it will keep good, they will come out much better in the end. Again, perhaps the soil of a man's farm is low, springy, wet. Then the feed will be sour. You can't get nice butter out of that either in dairy or creamery. The flavor of the butter largely depends upon the flavor of the grass. Rainy weather makes sour butter. In order to make fine butter in the winter time, you must go into your stable in the morning, and with warm water and sponge wash the udders of the cows, and wipe perfectly dry with a cloth. If your herd of cattle stand in a thick atmosphere, breathing the gases rising from urine and manure, you will find your milk tainted by these gases. It depends on circumstances, whether it is safe to set down a pail of milk in such a place. Just as soon as the milk comes to the exact temperature of the surrounding air, it absorbs the impurities therein. Another trouble in the butter business is that farmers persist in packing butter in tubs without first soaking the tubs. In order to preserve your butter you must soak your tubs in the strongest salt and water you can make, for at least twenty-four hours. After having soaked your tubs you put in your cloth and put on your salt; the cloth should be wet in strong brine. After three days you will find a little shrinking away from the tub, of one-eighth to three-eighths of an inch, caused by the butter solidifying. Then put in enough strong pickle to fill this space between butter and tub. This is the only way of making butter and packing it to keep. In regard to the creamery business, it would not probably be convenient here in Vermont to run the necessary number of cows. It is usually necessary to have from five hundred to fourteen hundred cows to run a creamery, although the size of a creamery does not always indicate its profitableness.

The speaker then replied, in answer to questions from the audience, that he would recommend the use of butter color, not enough to give a red color, better too little than too much; that the average number of pounds of milk required to make a pound of butter was twenty-four; that salt was the best preservative; that butter should not be overworked, and always worked by hand; that butter should be packed right from the churn; that ice should be kept in the milk room to condense impurities.

Dr. H. A. Cutting, Secretary of the State Board of Agriculture, gave an excellent address on "Milk," which we omit here, as it will be printed in the Appendix to this report. Following the address of Dr. Cutting was the poem by Laura Brigham Boyce, entitled "A Song of the Dairy." The poem was a very graceful and well conceived production, abounding in apt classical allusion and flashes of genuine wit, and at its close was warmly applauded by the audience.

Mr. A. W. Cheever, of the *New England Farmer*, then read a paper on "Fertilizers." No topic is of greater importance to the average New England farmer than the matter of the use of commercial fertilizers. There is a general impression that farming, and especially New England farming, is not a desirable occupation to follow for any

one with any degree of ambition. The cultivation of the soil is looked upon as a necessary evil. A clergyman recently said to me, "I always thought I would like to be a farmer if I could have a good farm, well stocked, and enough money so that I could hire all the work done." This reflects the general sentiment. Such was not the sentiment fifty years ago. Were our fathers better farmers than we? I will not admit it. One of the great evils has been the constant cropping without the return of anything to the soil. Such agriculture is unworthy of the name. It is not agriculture, but robbery. The days of soil-robbery in New England are nearly past. We are compelled to compete with the soil-robbers. There are compensations that render New England as desirable a place for the farmer to locate in as there is in the country or in the world. The land can be made as good and the prices for farm products are higher. The Western people want our young men and our money, to develop the country, and hence they furnish glowing reports of the fertility and productiveness of the West. Our dwellings are better and more comfortable than theirs, and indeed as palaces compared with them. The conditions of life and living here are much more favorable than at the West. Our people ought to try and build up and develop their own part of the country instead of the West. The question now put to the New England farmer is, can I longer afford to stay here when so much greater returns await me in the West. If he stays here he must be active and industrious; he must keep up with the times and the newest agricultural ideas and developments. Such men our New England farmers are becoming. A writer on Colorado says that the average net profit on wheat per acre there is $6.67. If the Vermont farmers can not do as well as that they certainly ought to go to Colorado. The old Eastern States are producing the largest crops per acre in the country, and the reason is that our farmers are better farmers than can be found elsewhere. Something can not be got out of nothing. The law of compensation is universal in its workings. The time has not yet come when an intelligent farmer can not build as good a home for himself in New England as anywhere in the world. What New England wants is better culture and more of it.

The wealth that is taken out of the soil ought to be put back into it—into more comfortable residences, larger and better barns, books and the conveniences of living. The truth is, the true principles of farming are just beginning to be understood. Nature perpetually restores herself. She clothes her rocks with material for plant growth. She covers her forest floors to a great depth with the richest soil. But by continually cropping we make the soil barren. How can we sell our crops from the farm and still keep the soil fertile? It can be done. Thirty years ago I was told that farming in New England was no longer profitable. I did not believe it then nor do I now. We can not follow the old system and make farming profitable. The question is, what crops can we raise from the soil and what substances can we put upon the soil which will leave it at least as fertile as it was before. We are pouring our wealth away through the sewers and sending it abroad in the shape of live stock and farm produce. The individual farmer can do little to check this, but there are some things which he

can do. He can have a proper rotation of crops. Dairy farming is a less exhaustive form of agriculture, but there are a great many unnecessary wastes in our system of dairying. Can Vermont farmers afford to buy commercial fertilizers? Yes, when they know what they want and how to apply it. If they sell nothing but butter they need no commercial fertilizers. Otherwise they do need them and cannot afford not to buy them. They can afford to feed corn to swine; and to buy grain to feed to cattle. A more direct method of fertilizing the soil is to use the commercial fertilizers. My first experiments in this direction were not eminently successful, but later I have made every acre as fertile as was the best acre when only stable manure was used. Hauling stable manure is expensive business, and here is a great advantage of commercial fertilizers. The benefits of these, too, are lasting. It has been my practice to give a moderate dressing to each crop. The commercial fertilizers are more easily applied than stable manure. The experience of Vermont ought to be similar to that of Massachusetts, and it would undoubtedly be so. There is no fertilizer which is the best for every one to buy. For myself I use a fertilizer composed of 1050 pounds of dried blood and butcher's refuse, 600 pounds of bone dust, 250 pounds of muriate of potash and 100 pounds of liquid potash. Our profits must in the first place come from small areas well cultivated. When we learn to do this we can keep our children on the farm and make New England what it should be and what our ideal of it is.

At an early session of the association, it was brought to its notice that Hon. E. D. Mason, its first president, which office he held for thirteen years, had died since its last meeting. A committee was appointed to prepare and offer resolutions proper to an event so intimately relating to the association.

The following were reported and unanimously adopted:

WHEREAS, Since our last annual meeting, the Vermont Dairymen's Association, in the death of Hon. E. D. Mason of Richmond, has lost one of its originators and one of its most faithful members; therefore,

Resolved, That in his death the dairymen of the State of Vermont lose an earnest co-laborer and a faithful friend, whose genial nature and kindness of heart won for him the friendship of his associates.

Resolved, That this association has the fullest appreciation of the work done by Mr. Mason in organizing the dairy interest of the State and the country, and feel that his success was a worthy laurel for any man to carry to his grave.

Resolved, That this association, at whose head he has stood, as president, for thirteen years, extends these expressions of kindest sympathy to his family, who best knew his virtues and most keenly feel his loss.

F. D. DOUGLASS,
C. G. PECK,
H. W. VAIL,
Committee.

The closing session on Friday morning was addressed by President Buckham, who said that he probably owed his frequent invitations to address the meetings of the Dairymen's Association to a desire on the part of the association to show respect and good-will to the University of the State. For such a courtesy he desired to express his thanks, and would always be happy to do what he could to increase friendly relations between the Institution and the farmers of the State. Much

of the best blood of the college came from the farm homes. He hoped also that he might consider such invitations as a desire to hear other subjects discussed than those peculiar to farmers. A great opportunity would be lost if such a representative meeting of the farmers of the State should separate with no word spoken on the great themes which are of common interest to all men, such as schools, home-life, social and political duties and opportunities.

The president then touched briefly upon (1) the common schools of the State, urging upon the farmers the duty of seeing, in their several localities, that the schools are well looked after, and insisting that any three determined men or women in a district can make the school such as they desire; (2) the town or district library, as a means of carrying the information on education of the community far beyond the curriculum of the schools; (3) the "long winter evenings," giving opportunity for an amount of reading or other personal cultivation which, accumulating from year to year, might give some of the results of a liberal training; (4) the duty of lightening the labor and hardship naturally falling upon the women of the farm household, a reform which has already advanced further in dairying than in any other branch of farm industry, and (5) the social and political duties and responsibilities of farmers.

At the Rutland meeting in 1872, in answer to the president's question, it was said that ten per cent. of Vermont butter was first-class. The proportion is very much greater now. Twenty years ago in Burlington it was difficult to buy a pound of good butter. Now there is no trouble. In all these improvements the Dairymen's Association has had a large share, and should have the confidence and patronage of the State as one of its most progressive and useful institutions. [Applause.]

At the close of President Buckham's remarks, resolutions of thanks were passed to the speakers, to the city of Burlington for the free use of its City Hall, the railroads for the courtesy of free return checks, and adjourned with the feeling that it had been a very successful and profitable meeting.

ST. JOHNSBURY MEETING.

THE FIFTEENTH ANNUAL MEETING

was held in St. Johnsbury, beginning on the 23d of January, 1884, and was generally considered the most successful one held for many years.

Col. Mead opened the meeting with some general remarks, and was followed by M. W. Davis, Esq., of the State Board of Agriculture, on the importance of the objects of the association, and speaking highly of what it had accomplished.

Next, the secretary, Mr. Tinkham, gave a short talk which might be called "hearsay evidence concerning ensilage." Mr. Tinkham said, that hearing some doubts expressed as to the quality of butter made from feeding ensilage, he went to Boston and interviewed the butter dealers there on the subject. Most of the wholesale, and many of the retail, dealers had no experience in the matter—did not know whether they had handled it.

Crosby Brothers, twenty-five years in business, have handled one dairy some years. In 1882, in January, the owner began to feed ensilage, and for awhile they thought the dairy had improved, but now it was not as good as formerly. They could not say whether ensilage had anything to do with either the improvement or the decline of the butter.

Green & Company have handled very little of it; have one dairy where it is fed and thinks the butter has improved since he began feeding it, but can't say from what cause.

H. A. Hovey has one dairy where ensilage is fed and had never had any trouble with it.

Burt & Harris think they have had ensilage fed butter, but have not perceived any difference; noticed at one time last summer a flavor of fresh mackerel in butter from Vermont, New York and Iowa, at about the same time, and could give no idea as to its cause, thought possibly it might be referrable to the salt.

Belknap & Boynton. Mr. Belknap said (speaking of the "mackerel flavor,") that a certain brand of salt would produce that flavor if the butter salted with it was kept long. He remarked that the true "inwardness" of the "New York milk war" was because the milk would not keep sweet till the customers could use it—would not stand twenty-four hours. Many of the cows were fed ensilage, and the taking into the system of so much acid would, after a time, so permeate the system as to affect the keeping qualities of the milk and the flavor of the butter.

Gass, Doe & Company reported that for some years they had handled a dairy which they classed as their No. 1 butter, and paid for it as such. One shipment came on which was "off" in character. Some trouble, but could not tell what; did not know but the party had changed butter makers; but it had to be sold for a lower price. It was good color, perfectly made, but poor flavor. After a shipment or two the man took away his butter, and they found from a neighbor that he had begun feeding ensilage.

Benton, Caverly & Company. Mr. Jackson of this firm was interviewed. He never saw a silo or ensilage, though thirty years in the butter business, and sold probably two hundred and fifty pounds of butter per week at from sixty cents to a dollar per pound. He had handled one dairy which in summer was *fine*. In the winter there came a shipment which was poor, and wrote the party that there was some trouble. The color was good, butter well made, but it smelled old; was "off" in flavor, lacked character. He wrote him that probably some one else could give him more, and the maker took his butter away. This experience has been duplicated in several instances, and in some dairies where they had made several hundred pounds per day. He cannot sell butter made where ensilage is fed. Last winter he sold some, considerable, and at twenty-five cents, when good tub and lump would bring readily from thirty-five to forty-five cents. Has no confidence in ensilage as feed where first-class butter is desired, and it must seek a lower class of trade to find a market.

Mr. Tinkham said this was from his notes taken at the time and referred to ensilage only on its bearing on the butter product, not on its

economic value as a food for stock, and he submitted it without comment, except that dairymen should be posted without prejudice on the opinions of butter dealers on whom they depend for a market.

A FARMER SAYS A WORD.

W. I. Simonds, a pleasant-faced, witty farmer from Roxbury, then took the platform. He had never made less than two hundred pounds per cow, and built a silo in 1882. From October of that year to October, 1883, he sold over three thousand pounds of butter from nine cows, after supplying the family. His wife, who was opposed to the silo at first, and was a good deal smarter than himself, acknowledged that they never made so good butter in the winter. It sold as well as ever, bringing a few cents more than creamery quotations. His cows were native and Jersey mixed.

His silo cost him about $200, and it was a hard and costly job to put it in, and he had sometimes thought if he had put the money into some good fertilizers and the fertilizers on his grass lands, that it might have been about as profitable. When asked whether his silo paid, he said he could hardly tell, or how he should have succeeded the other way.

"But after all," persisted Mr. Tinkham, "if an earthquake should swallow your silo, would you build another?"

"No, I shouldn't. It's a great deal of expense and a good deal of bother. If I had it to do all over again, I should put my money into fertilizers. Good grass fields, rich enough to yield two tons an acre twice a year, make pretty good butter."

Mr. Edward Burnett of Southboro, Mass., and proprietor of the celebrated "Deerfoot Farm," read a paper (which I much regret my inability to give entire, but his absence in Europe prevents my obtaining it in season for publication) on "Breeding to Win." He commends the practice of breeding from the best animals, and especially was this of importance in the bull, and a bull from a good butter strain was cheaper at $100 or $500 than a poor animal for nothing. The Guernsey he considered one of the best dairy animals, in some respects surpassing the Jersey. Several visits to the Jersey and Guernsey islands had convinced him that early maturity and good shelter were good things. He liked good, substantial cows rather than thin legged, dainty cattle. No Alderney cattle had ever been brought to this country. Those called Alderneys were really coarse-grained Guernseys. Replying to a question, he said that the Jersey cattle were cared for on their native island by women. They are members of the family and are much petted. Three times a day they are tethered and get a sweep of about three feet of clover up to their knees. About half of the winter they are fed hay, parsnips, cabbages and potatoes. He thought there was no danger of a diminution in the value of good butter cows.

After Mr. Burnett's remarks, Dr. H. A. Cutting, Secretary of the Board of Agriculture, gave an interesting and instructive address upon the "Care Necessary to have Sweet and Sound Milk." (See Appendix.)

At the close of his lecture he was plied with numerous questions, which were satisfactorily answered.

In the evening, in response to a general desire, Mr. Burnett took the platform and gave a vivid description of his visit to Holland, and the excessive neatness of the Dutch in their houses, and especially in their stables and dairies. The stables are washed and the floors sanded and the walls whitewashed and everything actually shone with neatness. They were so clean that cheeses were cured in them. Answering questions, he said from twenty-two to twenty-eight pounds of Holstein milk was required for a pound of butter, while sixteen pounds of Jersey milk did the business. "Bomba" made a pound from nine and one-fourth pounds of milk. He fed his cows twice a day in courses of different kinds of food, such as hay, grain, roots, etc. He preferred feeding grain dry because the cattle couldn't eat it so fast. He gave cows warm water to drink in the winter, thereby saving twenty-five per cent. of feed. He spoke of the importance of feeding calves oftener and less at a time when teaching them to drink, and that the milk fed was often too cold. Milk so fed would produce scouring, and when fed too much calves often die. Three-quarters of all calves that die are killed by eating too fast and too much at a time.

Following Mr. Burnett, Mr. E. A. Harris, of the firm of Burt & Harris, Boston, who kindly consented to judge on the butter exhibit. He said that the number of customers in Boston who would pay from sixty cents to a dollar a pound for butter was now quite limited and the supply about equal to the demand. That butter sold most readily which was put up in balls, boxes or nice tubs, at forty cents. Butter should not be kept through a season from August because it becomes oily. The best way was to sell once a week. If only one-half ounce of salt was used to the pound, it would have to go twice a week. Butter should be put up in all forms. That in boxes would bring on an average three cents above the tub price. The boxes known as the "Tinkham" box, and designed, he believed, by the secretary of this association, was the neatest and best of the boxes. Boxes lined with paraffine affected the quality of the butter unfavorably. He did not object to artificial coloring. Oleomargarine he considered a curse to the dairy interests.

THURSDAY MORNING.

Session opened with a talk by Dr. Drew of Danville on "Ensilage." There is no doubt but this question of ensilage is to be one of great importance for some time to come, till its proper place and just value is settled. Dr. Drew was a strong advocate for ensilage, and gave his experience in its use, which was favorable.

After Mr. Drew, Mr. Wolcott of Dedham spoke in favor of the system, and was questioned to considerable length. At the close of Mr. Wolcott's talk, a vote was taken to see how many present had tried ensilage with success, and expected to continue in its use. Thirty-three voted for it, and the opposite being called, two only responded. It was then proposed that the same vote be taken at the next yearly meeting, which was ordered and put upon record.

Mr. George Bachelder of Stanstead, P. Q., read a paper on "Abortion in Cows," which is published entire in appendix. Next was a paper by A. W. Cheever, Esq., of the *New England Farmer*, who

when invited to read a paper at this meeting, made excuse that he had spoken at so many meetings that he feared they would have tired of hearing him, but we judge that the close attention given while reading his paper and the hearty applause he received at its close must have convinced him that his "Farmers' Mistakes" did not apply to his paper before this meeting.

In the evening, Hon. W. W. Grout read a paper on "Common Law on Common Topics," which is published entire in appendix.

At the close of the meeting many of the members attended a reception tendered them by Gov. Fairbanks, where a very pleasant hour was spent.

To those who so kindly assisted us in our work we give our hearty thanks, and we should not omit the vote of thanks, something more than mere form, which was given the railroads for their courtesy in granting free return checks.

A prominent feature of this meeting was the "butter exhibit," numbering over eighty samples, was by far the largest ever made in the State, and, with one exception, the largest in New England. The samples were divested of all names and marks, the names of makers taken off on a list, and given the same number as was placed on the butter. The descriptions which accompanied were marked the same, and filed away by the secretary, (there were several descriptions which had no name given, and it could not be ascertained where it came from.) Not till all this was done was the judge in the exhibition room, and when he came and begun his testing all he had for a guide was the butter in its various styles, each on a slip of paper on which was the number. Each sample was bored and tested from its middle to get the true flavor and quality. No person was present with the judge while the examination was in progress except the secretary, who took down the numbers and remarks of the judge as the exhibits were passed upon. Many of the descriptions were not full, but did very well on that score. The directions given were to mark No. 1 all such as he would put on his counter as ranking with Iowa creamery, and retailing at about forty cents per pound. Any poorer was to rank No. 2, 3, etc., and if any was found better it was to be classed "Fancy." One sample only was classed as such—No. 30, made by Geo. B. Williams, Esq., of Walpole, N. H. Remarks by judge, Pretty high color, but right shade; best sample struck yet; lightly salted, comes nearest the butter sold as fancy at seventy-five cents to one dollar a pound. I could sell that to a customer of mine for seventy cents. Description by maker: cows, full blood Jerseys; feed, hay cut before blossoming twice a day, rowen once, two quarts yellow corn meal twice a day; set in cold air twenty-four hours, cream stands till slightly soured; Bullard's oscillating churn. When cream is just "breaking," two quarts of brine half as strong as will dissolve is added to thirty pounds of butter, then churned till gathered, when it is drawn off, brine and buttermilk worked out, salted with one-half oz. Higgin's salt, stands twenty-four hours, then put in prints, uncolored.

(I may say here that since the close of the exhibition I have received a letter saying the writer understood Mr. Harris, the expert, was a member of the firm to which Mr. Williams sent his butter, and that

he probably knew the sample. Mr. Harris is not connected with that firm, and never has handled Mr. Williams' butter, nor did he know that or any other sample on exhibition. Besides this, Mr. Williams' butter was not in the shape in which it is marketed.)

Of the eighty samples, about sixty were marked No. 1, sixteen No. 2, three No. 3, and one No. 4. The No. 4 was very poor, poor in grain, poor in flavor, rancid, not worth ten cents per pound. There was neither name nor description with it. It was in a box, done up in a dirty brown cloth looking like a dish cloth, and the same lack of care and neatness shown in the exhibit doubtless prevailed through all the method of manufacture.

The No. 2 was very fair butter, not more than two to four cents per pound off from No. 1. No. 3 still poorer, ten cents off from No. 1. Some of No. 2 was put down on account of lack of color. Would prefer colored to a right shade to having it too white.

NO. 2 LOT.

No. 4. Remarks: "Good color, good grain, rightly salted, off flavor." Description: cows, grade Jerseys; feed, hay in morning, ensilage noon and night, four quarts shorts, one quart corn meal, Cooley creamer; set twenty-four hours; cream heated to ninety degrees, and added to that in cream can; churned slightly sour; Wells, Richardson's coloring; washed; one ounce Higgin's salt worked after setting.

No. 6. "A little bit bitter; just enough to take out of No. 1." Cows, grade Jerseys; feed, corn and cob and barley meal; Cooley creamer; twenty-four hours at temperature of forty to fifty degrees; churned sweet; washed in two waters; salt, three-fourths ounce, and worked on ladle worker.

No. 7. "Off in flavor." Description: cows, grade Jerseys; light feed of hay in morning; water and feed, half bushel; ensilage mixed with one quart cotton-seed; three quarts of half corn and cob meal; half shorts. Feed of hay at four P. M.; water, and at six P. M., same feed of ensilage and meal as in the morning; milk set in Champion creamer; milk drawn from cream at twelve hours; ripened or slightly soured; churned at sixty-five degrees; washed in water of same temperature; salted one-half ounce Higgin's salt to the pound; colored with Wells, Richardson & Co.'s coloring; churning; washing and salting down entirely by Eureka churn.

No. 9. All right but not high color enough; should have been colored.

No. 14. Good, but lacking in color. Cows, grade Durhams; feed, night and morning as much good hay as will eat, and one quart each of corn and cob and cotton-seed meal; noon as much cut corn fodder and two quarts corn and cob meal. Milk set in six-quart pans; dairy kept at sixty-two degrees.

No. 19. Salted well enough; poor flavor; almost bitter. Cows all high grade Durhams; fed good hay; one quart each of corn and bran night and morning, and one peck of potatoes to each cow per day. Milk set in Cooley cans, kept covered in a cool room in winter and submerged in summer.

No. 27. "A trifle light in color, and too much and too coarse

salt; 'grits' between the teeth." Cows, grade Jersey; feed, hay and roots; salted one and one-half ounce to the pound; use Landon's and Higgin's salt.

No. 32. "Poor grain; not solid; sweet, but lacks flavor." Cows, common grade; fed nothing but hay, and one feed of cornstalks every other day. Milk set in sap buckets in summer in tank of running water; skims when sour; churns once a week; when butter comes about the size of a kernel of corn, pours in a pailfull of ice water, and wash till water is comparatively clear; uses Thatcher's color; salts one ounce to the pound.

No. 51. Poor flavor. Cows, grade Jersey; fed hay once and ensilage twice a day, and two quarts meal, (one-third corn, two-thirds shorts) per day; milk set in small pans; skimmed when turned; churn twice a week; butter washed; salted one ounce to the pound, and worked three hours after churning.

No. 60. Attractive form; a foreign flavor suggestive of oysters. Cows, grade and full blood Jersey; feed, half bushel ensilage, two quarts meal, two quarts shorts, and straw night and morning, with feed of hay at noon. Set in Wooster's creamery; skimmed in twelve hours; cream allowed to ripen; colored with Thatcher's; salted one-half ounce Ashton; put in print.

No. 62. "Same flavor as in 60." Cows, grade Jerseys; feed, ensilage and corn stover, with pint of cotton-seed meal, quart of corn and cob and oat meal per day; Cooley creamery: Stoddard churn; Wells & Richardson's color; Higgin's salt, one-half ounce to the pound.

No. 63. "Trace of some flavor; something I am not used to." Cows, grade Jersey; feed, ensilage twice and hay once a day, four quarts meal per day, (half bran) one-fourth each corn and cotton-seed meal; Cooley creamer; Davis churn; Thatcher's color; washed; three-fourths ounce Higgin's salt; work two hours after setting.

No. 65. Well made; good color; poor flavor; grade Jerseys; hay and three quarts, equal parts corn meal and shorts, morning and night; hay or straw at noon; small pans; cream sour; churn sixty-four degrees; Thatcher's oil color; three-fourths ounce salt.

No. 69. Orange color too high; No. 1, but colored too much; no peculiarity in the make.

No. 67. Ornamental style; made too long; lost flavor.

No. 39. Strong on outside; lightly salted; think paraffine paper in which it was wrapped has injured it. Cows not stated; feed, rye ensilage in morning, corn ensilage at night, with steamed stalks for noon; three quarts each corn and cob meal and wheat bran. Milk set in Cooley; butter washed in weak brine; salted one-half ounce to the pound; worked again after standing four hours.

In the eighty descriptions we find eleven feeding ensilage. Of these eight were classed in No. 2, two in No. 1, and one I am unable to say where it was classed. So far as can be observed, washing or not washing exerted no perceptible force on classing, or the make of salt, or the coloring matter used. Some samples ranking as especially fine gave in their descriptions, "hay early cut;" some fed "bright corn stalks, cut and wet with hot water;" some, hay which was heavily clovered, which last was mentioned for its excellent flavor.

While cotton-seed meal appeared in several samples of No. 2, as it also did in No. 1, and other lots of No. 2, had largely of shorts and one of roots.

I much regret that some one took away one sheet of my notes so I am not able to give as full a report as I would wish, and some samples were misplaced in the exhibit by persons handling. Some sent no descriptions, and some signed no names. But enough has, we think, been shown to demonstrate that the feed of the cows exerts an unmistakable influence on the quality of her butter product. It is intended that this report shall reach every exhibitor, and those receiving it without marked numbers will know their butter was in class 1. Others will have their number marked.

Should there be another exhibit next year, and we are there, we shall try to secure fuller statistics, to make the exhibit and its lessons as full as possible, and spread them as broadly as possible before the dairymen of New England.

The Association is indebted to Dr. Cutting, the Secretary of the State Board of Agriculture, for his very kind and courteous offer to print the reports of its meetings in with the report of the Board, and also for the printing of a sufficient number of the reports in separate form for the members of the Association. Doubtless the Association will, at its next meeting, make suitable acknowledgement of the favor, which the Secretary personally takes great pleasure in doing at this time and in this report.

O. M. TINKHAM.

North Pomfret, April 15th, 1884.

The foregoing report of your secretary is respectfully submitted, as answering the requirements of the law, and appended thereto are various addresses delivered at meetings by "members of the Board of Agriculture," "members of the Dairymen's Association," "members of the Poultney Industrial Association, State Grange," etc., as well as from friends of these institutions and others interested in the advancement of education as applied to the cultivation of the soil and the comforts of our home life.

HIRAM A. CUTTING, Secretary.

The foregoing report was accepted and adopted by the Board, and ordered to be printed for distribution, together with the appended addresses. And the secretary is hereby directed to procure the printing of the same in such manner and number as he can provide for from the appropriations.

His Excellency, JOHN L. BARSTOW, Shelburne, President,

MEMBERS OF THE BOARD.

M. H. Buckham, President U. V. M., Burlington.

Hiram A. Cutting, Lunenburgh,
E. M. Goodwin, Hartland,
E. R. Pember, Wells,
Henry Lane, Cornwall,
M. W. Davis, Westminster,
E. R. Towle, Franklin.

Lunenburgh, Vt., July, 1884.

APPENDIX.

COMMON LAW ON COMMON SUBJECTS.

A Lecture delivered before the Vermont Dairymen's Association, at St. Johnsbury, January 23, 1884,

BY GEN. W. W. GROUT, OF BARTON.

Mr. President, Ladies and Gentlemen:—I have been requested to say something on this occasion upon the legal rights and liabilities of adjoining landowners concerning the establishment of lines between them and the right to trees standing thereon, including fruit trees and their fruit; concerning also the rights and liabilities of landowners as to highways passing through their lands, and as to fences and the liability for damage done by domestic animals.

You also ask something upon the law of contracts governing the hiring of labor and the sale of personal property, including the law of warranty and the statute of frauds as applicable thereto. An exhaustive treatise upon all these topics would fill quite a volume, and as I have neither time nor courage to write a book, I must content myself with a mere outline sketch of the law upon these subjects, and doubt not that the briefer it be the better I should have performed my task and the better it will serve your purpose.

CONTRACTS

for labor for a certain time as for a year or a given number of months at a given price per month, are held by the courts of this State to be entire, and the performance of the labor is held to be a condition precedent to the right of recovery by the laborer for any portion of the time covered by the contract.

As the necessary complement of this rule if the employer discharge the employe without sufficient cause, he may wait till the time covered by the contract has expired, and then recover of his employer pay for the whole term, though he actually served only a small portion of it. But he could not do this without first showing that he had been unable by the exercise of diligence to obtain employment elsewhere. If he has found employment for a part of the time, what he had received therefor, deducted from the contract price, would leave the sum he would be entitled to recover.

This rule applies not only to farm labor both in the field and the house, but to all contracts for labor, and leaves the parties just where they may have placed themselves by their contract. It should be remembered that it is never the province of the courts in the administration of law to make contracts for parties litigant. Courts only undertake to ascertain what contract the parties themselves may have made, and whether such contract has been broken, and if broken to award damages therefor; or sometimes as in equity to compel what is called "specific performance."

If it be suggested that the above rule seems arbitrary, and not calculated in all cases to work exact justice, it may be replied, if the parties would have a different contract they should make it different. Were they to agree that a contract for an entire period might be terminated at the pleasure of either party, then the contract would no longer remain entire if either party chose to end it. And if so ended the laborer could only recover, and the employer only be compelled to pay for services actually rendered.

The right reserved to terminate the contract in case of dissatisfaction is, practically, the right to terminate it at pleasure; for it has been held in this State that the laborer might recover in such case, although his dissatisfaction was capricious and without good reason. See Provost v. Harwood, 29 Vt. 219.

Of course, though the contract be entire, it may be terminated by either party for good and sufficient cause. But it is no excuse for abandoning a contract for service that the party had been put to, other than the stipulated service, if he made no objection thereto at the time; the law implying his assent by his performance of such other work without objection. Though the laborer may have performed other than the specified work, yet he could undoubtedly refuse at any time to enter upon other similar jobs, and were it insisted upon by his employer, it would be good cause for ending the contract. It is not, however, good cause that the employer refuse upon the laborer's solicitations to discharge another servant with whom he had difficulty: though unreasonable treatment by a fellow-servant whom the employer insisted upon retaining would probably be as good a cause for abandoning the contract as if the unreasonable treatment were directly from the employer himself.

It has also been held in this State that faultfinding and angry words by the employer towards his laborer to the effect that the laborer who was a foreman was not pushing the work as he ought, but was tolerant of idleness and listlessness in the men under him, was not sufficient excuse for leaving the service. See Forsyth v. Hastings, 27 Vt. 464. Disabling sickness would, of course, excuse the laborer from his contract, and he is not barred from recovering for his services though he neglect to return after getting well; nor would the employer be bound to receive him back. So, too, if a contract be broken by either party with or without sufficient cause, the other party may rightfully refuse to resume the contract. From the above—and further illustrations might be given—it will be seen that the rule first above laid down, though apparently harsh and rigid, is after all sufficiently flexible to

meet such emergencies as may arise under the contract of the parties, and to quite a satisfactory degree do substantial justice.

If one of two partners discharge a laborer from his contract, and the other partner request the laborer to return, he may refuse to do so and recover for his wages.

Under a contract for a specified time the laborer is not bound to make up for time lost with the acquiescence of his employer by working after the expiration of the term; nor is the employer bound to receive further labor in satisfaction of time lost, but is bound to pay only for service actually rendered.

THE STATUTE OF FRAUDS

Provides, among other things, that: "No contract for the sale of goods, wares and merchandise, for the price of forty dollars or more, shall be valid unless the purchaser accepts and receives part of the goods sold or gives something in earnest to bind the bargain or in part payment, or unless some note or memorandum of the bargain is made in writing and signed by the party to be charged thereby or by some person thereunto by him lawfully authorized."

The foregoing is the second section of our statute, the whole of which, with but slight alterations, was copied from the English statute of the twenty-ninth year of the reign of Charles II—1659—and has been in force in England since that time, and in our own State and all the other States of the Union since their foundation. Cases, almost without number, have arisen and been adjudicated under this statute, extending to every important word of it, and presenting almost every conceivable phase of transaction to which it could be applied in the vast and varied traffic of the world from that early day till now. Any attempt to present to the mind untrained in legal subtleties, even in the most summary way, the learning upon this subject would be more likely to bewilder than instruct; and probably the best exposition that can be given of the law governing contracts for the sale of personal property is to simply point to the statute itself; from which it will be seen that no contract for the sale of personal property of more than forty dollars value is binding unless the contract be in writing, or unless a portion of the purchase money be paid or a portion of the goods delivered. The farmer who, like

> "Bessy at her spinning wheel,
> Blest wi' content and milk and meal,
> W'e sma' to sell and less to buy,"

will doubtless be satisfactorily advised by this brief statement. If the gain-devoted trader would know more of the law upon this subject, any well informed lawyer would be able—and for five dollars would be willing—to tell him more about the judicial refinements upon the language of this statute than he would be likely to remember.

WARRANTY

In the sale of property may be either express or implied. There is always, in the sale of a chattel, an implied warranty of title in the

seller, if the chattel be in his possession; that is, a warranty that the seller owns the chattel and has a right to sell it. If, however, the chattel be not in possession of the seller, the law will not imply a warranty without affirmation of title. There has been much discussion upon this subject, but I believe this to be a fair statement of the rule to-day.

When an article is bought and sold for a particular well known use, there is an implied warranty that the article is fit for that use. And it has been held in this State that where cheese was sold by the manufacturer of it for a foreign market and for full price, there was an implied warranty that the cheese was fit for such market. In this case the cheese was found upon delivery to be more active than the market was for that kind of cheese; and as it was shown that the defect was latent and was the result of improper care and treatment in bringing the cheese to maturity, the plaintiff was allowed to recover damages. See Pease v. Sabin, 38 Vt. 432.

You will observe that the defect in this cheese was held to have been a latent one; which means hidden, not discernible on examination. The soundness of this view may not, perhaps, be very apparent to cheese makers, and certainly not to cheese eaters, and presumably not to ordinarily vigilant cheese buyers. Rumor tells of at least one buyer to whom this fault in a lot of cheese was not hidden, but was discernible with the naked eye, and presented a scene lively in the extreme; so very lively that he declined to purchase. Whereupon the farmer declared his intention of taking the cheese to market himself, and asked the purchaser the best way to transport it there. To which the buyer replied: "Keep it a little longer and you can drive it right in." But, apart from pleasantry, whether or not this defect was properly held to be latent, the above decision was undoubtedly correct upon the ground, alone, that the cheese was manufactured and sold for a specific purpose, and without any express undertaking, the law implied a warranty that it was fit for that purpose.

While the law implies a warranty in the sale of articles for a particular use, yet in the sale of all other articles an entirely different rule prevails, and there is no warranty unless one be expressed in the contract. *Caveat emptor*—let the purchaser beware—is the rule of the common law, which is ours by both inheritance and adoption; and he buys at his own risk. A sound price does not carry with it any warranty of soundness or other quality. Among the cases in this State in support of this doctrine is one holding that it is no defense to an action to recover the price of a cow sold, that the cow was so diseased as to be worthless where the sale was without fraud and without warranty. Bryant v. Pember, 45 Vt. 487.

The law is, if the purchaser desires a warranty he must ask for one, or make such inquiries as shall put the seller upon disclosure; and then the seller is bound to answer correctly. If he give false and misleading answers, and the purchaser is thereby cheated, he is liable as for a fraud. He may remain silent, but if by word or act he conceals a fault in the thing sold, and deceives the buyer, he is answerable in damages. But to make him liable upon a warranty there

must be a warranty. The word warrant, however, need not be used. Any representation of quality is sufficient; as that the horse is sound, which is a warranty of soundness, but of soundness only; or that he is kind, which is a warranty of kindness only. In Walker v. Hoisington, 43 Vt. 608, it was held that the representation that the horse was "sound and right" was a warranty that he was right in every particular; and covered a case of cribbing, whether that was an unsoundness or not.

In all cases it must be shown that the buyer relied upon the representations made in order to constitute a warranty and make the seller liable. The law is precisely the same in the exchange of property as in its sale.

The doctrine of *caveat emptor* which, as we have seen, puts the purchaser on his guard, has been severely assailed by certain writers as holding an open door for falsehood and fraud; but it is too well established by an unbroken line of decisions as old as the common law itself to be set aside or materially modified by the courts at this late day. Nothing short of legislative enactment will ever do it. Should it, however, be done, the rule substituted would undoubtedly be that of the Roman or civil law, which is the same, substantially, as that expressed in the French code adopted under the first Napoleon; which is, that a sound price implies a warranty of soundness. But to our New England States, and, indeed to most of the States, together with our Anglo-Saxon institutions, has come from the mother country the common law, which upon this point has always put the purchaser upon his guard; has always held that if the purchaser would know more about the article he may be buying than he is able to discover, let him ask, that he may receive the desired information. But if he relies upon his judgment and disdains to ask questions, and the article turns out different from what it appeared, let him forever after hold his peace. That this rule may not be misunderstood, it should not be forgotten that if the purchaser does inquire, the seller is bound to answer truthfully, and is liable if he says or does anything which misleads or deceives him. Under this rule, as a general thing, courts and juries mete out swift justice to the falsifier and deceiver in the sale of goods. Nor does mere smartness avail him. The Frenchman's answer to the inquiry if the horse was sound, that "he no look so well as some horses look"—when he was stone blind—might answer well enough as a bit of French shrewdness, but with the average juror would hardly protect from damages. Nor would the cuteness of the Yankee be more successful. The Yankee represented the near horse of a pair to be the best horse he ever saw. And of the off horse, which was a well looking one, he said he did not know why he was not just as good. The purchaser found the near horse entirely satisfactory, but the off one was a vicious, worthless brute. When he spoke to the Yankee about it, the Yankee replied as follows: "I said I did not know *why* he was not as good as the near one; and for a truth I did not know *why*, but I am frank to admit that that off horse is really the meanest horse I ever saw.

As a rule courts and juries make quick work of every such subterfuge and sham, and with a firm hand hold parties up to the spirit as

well as the letter of the law. The seller is bound to make full, fair and honest answers to all inquiries; and whoever attempts to shield himself by equivocal and misleading language like that of the Frenchman or the Yankee, is sure to find his armor riddled by the shafts which Anglo-Saxon justice has ever held for the ready defense of this Anglo-Saxon rule of law.

GUARANTY

is another subject I am asked to say something about. The law of guaranty treats, among other things, of the liabilities of endorsers and sureties upon commercial paper, and abounds with nice distinctions laid down in numerous decisions. But were you to know all the learning upon this intricate subject, and understand perfectly all the subtle rules which have been formulated by legislative bodies and courts of judicature, and which are supposed to be the very best product of the aggregate experience and judgment of the ages, there is still one wiser and safer thing you may do, and that is not to allow yourselves the honor of becoming surety or endorser except in very necessary cases and where the principal has your fullest confidence. The best law I can give you on this subject is not what modern jurists and law writers may hold, but shall be in the language of an ancient magistrate of very high authority and may be found recorded in that Book which contains the summation of all wisdom and all law both human and Divine: "He that is surety for a stranger shall smart for it, and he that hateth suretyship is sure." And again, "Be not thou among those that strike hands and are sureties for debts."

FENCES,

four and one-half feet high, and lakes, ponds, rivers, brooks, creeks, hedges, and ditches, or other equivalent things, are made by statute legal and sufficient as division fences. It is also made the duty by statute, of owners of adjoining occupied lands to build and maintain division fences, which may be divided between them by agreement in writing, duly witnessed and acknowledged, or by fence viewers if they cannot agree; and when so divided, and a record made thereof, such division is final between the parties, their heirs and assigns. After such division, if either owner refuses or neglects to build his part of the fence, the other may build it and recover the expense of the one refusing. If the land of one adjoining owner is unimproved and unoccupied, the selectmen may, in their discretion, excuse him from building any part of the fence; but if he afterwards improve and occupy his land, he is then liable to pay the other owner for his part of a fence, which the other owner may have previously built, what it is then worth. If a fence between A and B as adjoining owners is divided, and A's cattle stray into B's field through B's fence and do damage, B cannot recover, unless he shows that his fence was legal and sufficient. And though A's fence was insufficient also, yet if the cattle went through B's defective fence, B cannot recover, for his own negligence contributed to the damage.

But if the fence were not divided, then no particular fault could be fastened to B, and he could recover, for by common law the owner must restrain his cattle from straying abroad, or pay the damage they may do; and our statute in respect to fences, does not relieve from the common law liability. For instance, if A and B, adjoining owners, agree to dispense with a division fence, as it is perfectly competent for them to do, then each under the common law must take care of his own cattle; and if they do dispense with such fence, then if the cattle of C, who lives on beyond B, were to get into B's field, and thence into A's, and there do damage, C would be liable; and it would be no answer for C to say that A had no fence between himself and B; for the statute imposes no obligation to build fences, except as between adjoining proprietors, which in the supposed case they have mutually dispensed with.

C's liability must be ascertained not by A's duty to B, but by the rights and liability between A and C. As they are not adjoining landowners, the statute does not apply to them. But the common law, the bed-rock of our institutions both political and judicial, does apply. It provides that every man must keep his cattle at home. If they stray upon his neighbor's land it is his trespass. In the supposed case, C's cattle strayed into A's field, therefore C is liable to A for the wrong.

Railways are bound by statute to fence their roads, and if cattle rightfully in the adjoining field get upon the track through a defect in the fence, and are injured or killed, the corporation would be liable. But if the cattle were estrays in that field, did not belong there, though they went upon the track through a defective fence of the corporation and were killed, yet the corporation would not be liable, unless the owner of the cattle could show that the corporation by its servants acted negligently or wantonly in managing the train, and did not stop it when they might have done so. Moreover, if estrays in that field were thus to go upon the track and wreck a passing train, the owner of such estrays would be liable to the corporation in damages; for as we have already seen, it is the common law duty of the owner of cattle to keep them at home.

HIGHWAYS

May be established by dedication and adoption and by adverse use, as well as by proceedings under the statute authorizing selectmen of towns and the courts to lay and open them. The power of courts and of selectmen over the subject is well known to all; but perhaps all do not as well understand how by operation of law the conduct of the land owner and of the public may as effectually establish a highway. And here again the common law, which is but another name for common sense, steps in and controls. As early as in 1829, it was decided in this State, upon the authority of certain English cases, that if a landowner, by unequivocal acts, set apart a portion of his land, as for a common or a highway, and the public enter upon its use, he cannot afterwards reclaim it. And if the town thereafter expend the public money upon such highway, it then becomes in every sense a public

highway; and the town would be liable for indictment for its neglect and liable in damages for injuries received thereon.

This is what the law denominates a highway by dedication and adoption. It stands upon the unequivocal, concurrent acts of the landowner and the public; and mere lapse of time is not an essential ingredient. Especially must the act of dedication be unequivocal. It has been held that an omission to build a fence between the highway and adjoining land is not of itself an act of dedication, for since 1839 the owner is not required by law to fence his land along the highway. Nor is the act of throwing or leaving open to the public travel land in front of his dwelling or place of business for the accommodation of his customers any evidence of dedication.

Where the right of the public to the use of one's lands, as a highway, depends upon mere enjoyment, fifteen years adverse, continuous use is necessary to perfect the right; and the extent of the acquiescence—as the width for instance—will be determined by the extent of the actual occupation and use.

The only right which the public have in a highway is to use it for the purpose of travel. The fee or right of soil remains in the owner of the land through which it passes, and he may continue the use of the soil for any and every purpose not inconsistent with the enjoyment by the public for the purposes of a highway. He may depasture his cattle upon it; he may cut and gather the grass growing upon it; he may cultivate crops thereon and harvest them; he may plant the margins thereof with fruit bearing trees or bushes, and the produce is his and his alone. So also are the wild berries that may there be found. And any one converting the grass or fruit or berries would undoubtedly be liable in trespass to the owner of the land. But were such owner like *Snagsby* to put so fine a point upon his legal rights as to seek to recover for the conversion of wild berries, very likely it would be held that this could not be done until after notice to the offending party not to gather such berries; for in this State the custom has always prevailed of picking wild berries wherever they could be found; which might he held to amount to an implied license. But after notice by the owner of land to a person not to pick such berries on his land, either in the highway or in his field, I think if he persisted he would be liable in trespass.

The title to the soil within the limits of a highway would not belong to the adjoining owner, unless the land was included within the boundaries of his grant; and if not so included he could not maintain trespass for a private appropriation of it. But if included in his grant, should the highway be discontinued the land would revert to him; and while the highway was continued, everything in it would belong to him the same as before the highway was laid, subject only to the easement which the public have in their right to pass over it. And as an incident to this easement the officers of the town have the right of digging the soil, and using the timber and other materials found within the limits of the highway for the purpose of building or repairing the roadbed and bridges upon it. And such materials may be rightfully carried beyond the landowner's line, and used to build or

repair the road upon the land of another. Baxter v. Winooski Turnpike Co., 22 Vt. 114, and Field v. Gilmore, 22 Vt. 38.

The owner of cattle who allows them to feed in the highway on his own premises is not liable for any accidental injury they may do there, unless the circumstances and occasion of their being there, or the character and habits of the animals were such as to show carelessness on the part of the owner in respect to the safety of travellers on the highway. But if they were to stray beyond the limits of their owner's land, and there be the cause of an injury to a passing traveller, the owner of the cattle would be liable, providing the person sustaining the injury was himself wholly without fault in respect of the accident. So, too, if such animals were straying in the highway upon a neighbor's premises, and were to injure some animal belonging to such neighbor, the owner of the stray cattle would be liable. But if some animal belonging to the neighbor were to injure the cattle so straying, their owner would be wholly without remedy, for the reason that his cattle were wrongfully there.

So, also, I should say if the landowner did not fence his highway, and damage happened to the crops in his adjoining field by animals driven along the highway in a prudent and careful manner, he could not recover; for the person driving the cattle along the highway would have a right there; and if he were no way in fault, it would be what the law calls *damnum absyne injuria*—damage without a wrong. Of course, if the animals were estrays in the highway, and entered the field, the owner would be liable for all damage. Indeed, I think he would be liable in trespass if such estrays did not enter the field, but were allowed to remain and feed upon the grass and herbage within the highway.

If a person find domestic animals trespassing in his field, he is under no legal obligation to put them into the pound, but may turn them into the highway, and would not be liable to the owner, though the animals were wholly lost. Nor is he liable though he do this with intent to injure the owner of the animals; for whatever a man has a legal right to do, he may do with impunity, regardless of his motive. See Humphrey v. Douglass, 11 Vt. 24.

And it has been decided in this State that he would not be liable though he set his dog upon the animals in driving them out, provided the dog was not too large or too ferocious for the size of the animals; or in other words, if he did it in a prudent and careful manner, even though the dog injured the animals. Clark v. Adams, et al., 18 Vt. 428; Davies v. Campbell, 23 Vt. 288. Verily the way of trespassing cattle is hard. It is evident also that the law deals severely with the man who suffers his cattle to run at large, for the manifest purpose of encouraging the building of good fences. "Good fences not only make good neighbors but are a sure sign of an advanced civilization."

LINES

dividing the lands of adjoining owners are a pregnant subject of dispute. If the line be an original lot line, or an ancient line subdividing a lot, that will always govern, if it can be found, unless the par-

ties by mutual agreement or equivalent acts have established a different one. An agreement between adjoining owners, if in writing, duly witnessed, acknowledged and recorded, would be conclusive not only upon them but would run with the land and be as conclusive upon their grantees as upon themselves. Lines may also be established by prescription, that is by the claim of one owner that it is in a given place accompanied by uninterrupted acts of ownership or possession for the space of fifteen years. To establish a line by prescription or by possession, as it is sometimes called, the possession must be peaceable and continuous, and without legal interruption. It must also be adverse, that is, under a claim of right, and especially must it have so originated. If it had its origin under consent or by the license of the adjoining owner, or if any portion of the time it was by license, though it contained all the other requisites, was, for instance, peaceable and contiuous and without interruption and was for the required time, yet it would wholly fail. It would lack an essential element in that it would not be adverse. The recognition by the proprietors of adjoining lots of a particular line as their division line, and their acquiescence in this for fifteen years, with possession accordingly, either actual or constructive, of both or either of the lots, would establish such as the true division fence.

Trees standing exactly upon the line, so that the line would divide the trunk or body, leaving part on one side and part on the other, are the property of the two land owners jointly, and according to the proportion of the trunk upon their respective sides of the line. The owners are what the law denominates tenants in common of such trees, and either party may rightfully cut and appropriate them to his own use; but would, of course, be liable to account to his co-tenant for his interest therein. This right to cut and appropriate being liable only in account, is undoubted as applied to forest trees and others valuable only for timber or fuel. But should one tenant in common cut a fruit tree or valuable shade tree, it would probably be held such an invasion of the rights of his co-tenant that he would be liable in an action on the case, and perhaps in trespass for the wrong. According to the rule already given, the fruit upon an apple or other tree whose trunk would be divided by the line between adjoining owners, would belong to such owners according to the parts of the trunk upon their land respectively. The landowners would be tenants in common of the fruit; and either, though forbidden, could gather the whole and not make himself liable, except in account to the other party. If the trunk of a fruit tree be wholly on the land of one adjoining owner, though so near the line that the roots would feed on the adjoining land and the branches overhang it, yet the tree and its fruit are wholly the property of the owner of the land on which it stands. The adjoining owner has no interest in the tree whatever, and if he gather the fruit, whether from the tree or the ground, after it has fallen, he would be liable—though his cattle might, perhaps, rightfully enough eat the fallen fruit.

There has been considerable discussion upon this point, and there are decisions holding that where the tree is near the line and draws

support from the adjoining land, the owner of that land is a tenant in common of the tree. But the case of Skinner v. Wilder, 38 Vt. page 115, settles this question in this State, and holds the tree to be the sole property of him on whose land it stands. It will be seen that under the other rule it would be impossible to ascertain what part of the tree belonged to each joint owner. From the very nature of the case the proportion of support it derived from each side of the line could not be ascertained without the complete uprooting and total destruction of the tree; and then only approximately. But some one may suggest that under the rule, as above stated, an individual might plant a row of apple trees, close to the line, upon a poor strip of land adjoining a rich piece of his neighbor; and that as the trees grew the roots would naturally reach out and find the best soil, and would be sure to feed principally upon the fertility of the adjoining field; and yet the trees and the fruit thereof—made abundant by the fat of his neighbor's land—would all belong to the owner of the lean strip. This supposition presents an extreme case and one not likely to arise. But should it arise, the owner of the trees would be likely to encounter difficulty in harvesting his apples. If the owner whose land the branches overhung was to forbid the owner of the trees going upon his land for that purpose, he would be liable in trespass were he to so do. He might lawfully gather what he could reach from his own land and probably what he could pick by climbing into the tree; but were he to get down upon his neighbor's land and gather them he would be a trespasser. His neighbor might, also, I should say, cut away the branches which overhung his land and the roots that fed upon it, and do this right upon the line between them, for bounded by that line he owns from the heavens above to the center of the earth beneath. I also think a court of equity would compel the owner of the trees to keep the branches thereof from shading his neighbor's land and to keep the roots thereof at home, were the amount involved sufficient to give equity jurisdiction. If these views be sound it will be seen that the owner of the lean piece of land would not be likely to get fat very fast off the fat land of his neighbor. And if he were to have as much law as his neighbor would be likely to give him, in the supposed case, he would soon be as poor as his poor strip of land; which with its trees of severed roots and mutilated tops would be a fit dwelling place for such as he. After the courts and lawyers were through with him he would present the same sad spectacle which one always furnishes who is ready to pursue his neighbor with some mere legal advantage, forgetting that courts and juries are always inclined to

> "Poise the cause in justice's equal scales;"

and that at last

> "Justice always whirls in equal measure."

DRAINAGE

of land where it may be necessary to cross the lands of another to give the drain an outlet, is the subject of a statute law in this State which provides that the selectmen may, upon application of one of

several persons whose lands would be benefitted by a drain, apportion such drain among the several proprietors and fix the time when each shall open his part of the drain; and in case the selectmen think any one of the landowners is not sufficiently benefitted to be called upon to bear any part of the expense, they may still give the others a right to open such drain across such owner's land, and in doing so they would not be liable as trespassers; but they must pay such owner whatever damage may occur to him after deducting the benefit, if any, to his land.

This is a recent statute, and I am not aware of any decisions by the Supreme Court upon it. A judicious application of the provisions of this act would very likely be highly beneficial to the agricultural interests of the State, and it will doubtless receive from the courts a liberal construction, and will be given effect if possible; but I must confess I do not quite see upon what ground it can be done. In short, I doubt the validity of this enactment, because of that provision in the constitution which provides that private property cannot be taken except for public use, and then only upon the payment of an equivalent in money. The point being that the use here proposed is not a public use, does not affect the whole public alike, but is a private use, benefitting only the adjoining land owners. It has been held by the Supreme Court of this State where land was flowed for the benefit of a grist mill under the flowage act similar to this in its provisions, that the act was unconstitutional, upon the ground that the grist mill was not for the public use within the meaning of the constitution; for the reason that the law does not compel its owner to receive and grind the grain of all alike for a common toll; the same as all alike may travel a public highway, or all alike travel a turnpike upon payment of a common toll; or all may travel upon the railway upon payment of a common fare. No one can be rightfully excluded from the highway or from a turnpike, or a railway train, who offers to pay the common fare. These corporations are all bound to serve the public, and hence the land taken by the right of eminent domain for these purposes is taken for the public use. But the owner of the grist mill is not compelled by law to receive and grind all grists that are offered. He may refuse whoever he chooses. Hence, the use was held not to be a public one, not common to all alike, and the act allowing lands to be flowed against the will of the owner for the benefit of a grist mill though upon compensation, was held to be unconstitutional and void, the constitution, of course, being the supreme law of the State. See Tyler v. Beach et als., 44 Vt. 468.

Now, judged by this rule, what effect can be given to this drainage act as against this principle in the constitution which secures to every man the control of his own property, as against every other man, and as against the supreme power of the State itself even, except it be taken for the use of the public? How in the light of this decision can the taking, by one man or by several, of the land of another for the purpose of opening a drain through such land, be claimed to be a taking for public use?

The first section of the statute provides that such drain may be

opened when " the public good or the necessity or convenience of individuals requires it."

In a case where it could be shown that such drain would promote the " public good," and such case might possibly arise, then such proceeding might be in harmony with the organic law of the State. But the proposition to take private property simply to meet " the necessity or convenience of individuals," as provided by this statute, must be looked upon as not only startling but really revolutionary. It is not only at variance with the plain language of the constitution, but strikes at the very foundation of all private rights; the careful protection of which has been the boast of our Anglo-Saxon institutions and the glory of the common law ever since Magna Charta; which in 1215, among many other things, provided for the inviolability of private property in almost the precise language of our constitution. But enough! If the right to open a drain upon one man's land because of " the necessity or convenience " of another ever comes before the supreme court, I shall expect that the act pretending to give that right will be set aside.

I should not, however, have alluded to this subject on this occasion, but it was named among those I was asked to speak upon; and though, perhaps, this is not in all respects the most suitable place for the discussion of a question of constitutional law, yet I trust the little that has been said may not prove wholly unprofitable. Indeed, if our organic law is what it ought to be, and what it really is, the charter of all our rights, both civil and religious, can we too often recur to it? Can we be too familiar with its provisions? Can we too carefully follow its requirements, not only in the enactment, but in the administration of our laws.

Let us not forget, in this busy scrambling age, the truth expressed by the founders of the State in our dear old bill of rights:

" That frequent recurrence to fundamental principles, and a firm adherence to justice, moderation, temperance, industry and frugality, are absolutely necessary to preserve the blessings of liberty, and keep government free."

Barton, January 23, 1884.

ABORTION IN COWS.

Paper read by GEORGE BACHELDER, Stanstead, P. Q., before the Vermont State Dairymen's Association, at St. Johnsbury, January 24, 1884.

The question is often asked, what is the cause of abortion in cows; as though there was one and only one cause for this seemingly mysterious trouble. In New York, commissioners have been appointed by the state to investigate this matter, and carried their investigations over the infected districts during a period of three years, offering a prize of fifty dollars to any one who could solve the mystery and give a certain and practicable preventive, but adjourned leaving the trouble unsolved. Various theories have been from time to time suggested as to the cause, and stock has been treated in accordance with the premises, resulting only in failure; since causes are constantly occuring which clearly disprove the theory. The impression with some that the land on which the habit most prevails is lacking in phosphates; or, that the crops in certain seasons are deficient in some element necessary for the perfect health of the animal, or full develment of its young, is by no means satisfactory. After nearly a quarter of a century of experience and observation with this trouble, we have come to the firm conviction that there is no one cause that produces this trouble, but that there are several, yes, scores of them.

Our first experience with abortion was distinctly traced to unwholsome food and a want of ventilation and drainage of stable. At the time, and just before the trouble broke out in our dairy, we were feeding what we then supposed to be the very best hay we had, which was the first cut, was put into the bottom of the mow, and directly over the basement cow stable. The spaces between the single flooring over the stable served as ventilators to conduct the foul air of the stable into the hay, where it was absorbed and retained until fed, which happened to be in that most precarious season when cows are most liable to abort. The floor of this stable lay on timbers imbedded in, and consequently on a level with the ground; causing the urine to collect under the stable floor to that extent that when walking on it would slosh up between the flooring, giving off a rotten and offensive smell.

There is something about the gases which escape from the evaporization of manure, and especially from that which escapes from pools of urine, that acts upon the organs in question; and, although no immediate effects are visible, yet its operations are slow, sure, and effectual. Causes may be silently and imperceptibly at work for months in a dairy, and yet the effects not be visible until the dreaded time arrives, when it culminates in abortion.

We see a parallel law operating on swine, when filth and manure are allowed to mix in their food, resulting in the by no means mysterious trouble, the hog cholera. It is a law in medicine, at least among the idopathic class, that a concentrated part of a healthy animal when taken internally will excite to a healthy action the corresponding part in the one so taking it. Pepsin, for instance, is a standard remedy for dyspepsia, and exerting healthy action of the stomach and gall, is a powerful stimulant to the liver. Now by a reverse of this law, the unhealthy or unnatural excitement of any organ leads to mischievous results. The want of drainage and the escape of sewage gas is now universally acknowledged to be the cause of many diseases in our overcrowded cities.

Our second sad experience occurred last spring when one of our cows was severely gored in the abdomen and just over the calf, pushing her violently against a post, causing her to abort in the stable about thirty-six hours after. As many of my dairy (with one exception) as were a little more than seven months in calf, took on the affection either through the sense of smelling or hearing, and perhaps both, and aborted. The one which escaped was a heifer carrying her first calf, and which on being turned to grass showed all the signs of calving; but the change of air and food caused her to recuperate, but in August she again commenced to make a bag, and in about one week after giving notice, aborted when seven months in calf, showing it remained latent for three months. I buried the calf and covered with dirt all signs or concomitants whereby the affection could be taken on by other members of the dairy through the sense of smell, and thereby spreading the trouble. This heifer I am now milking, and she comes in heat regularly about every eighteen days, and remains so for thirty-six hours each time; is healthy every way save showing an over-excited state of the genital organs. I should not dare to breed from her till her condition was normal, as a cow aborting her first calf is more likely to take on the permanent habit; and a cow that has once aborted is a dangerous thing to have about. I should have said, that, my dairy which aborted some years ago, did not abort the following spring, although it was an experiment which I am not following this year; that is, am preparing for the shambles such as aborted last spring.

Another fruitful source of encouraging this trouble is the mode of tying or confining cows in the stable. A case came under our notice where a breeder of thoroughbred Durhams had four-fifths of his cows abort the first season he occupied his newly purchased farm; tying his large cows in the upright stanchions, and standing on the slippery and steep floor, which inclined four inches in the length of the cow, causing the large cows to slip and fall upon their knees in reaching for their food and sometimes getting cast. The steep slant of the floor made the hind parts of the cows the lowest, causing the weight of her calf and its appendages to fall behind its centre or natural position, thereby bringing a constant and unnatural strain on the muscles of the parts in question, which strain is well calculated to produce mischievous results. The stable mentioned was remodeled the next

summer, and none of the same cows aborted the following year. But the greatest and most widely spread cause of this affection is a constitutional or hereditary weakness inherited by the heifer calves, which when they develop into usefulness and activity, causes them to be more liable to abort under slight provocations, such as accident, fright, unwholsome food, want of ventilation, and especially from excessive milking, whereby the general strength of the system is lowered, particularly where the milk producing qualities are stimulated by milk producing food at the expense or absence of muscle and bone sustaining food, which, when joined with constitutional imperfections, has its influence in developing and inviting this increasing trouble. The bull calves too inherit a constitutional weakness, and when brought into use and are overtaxed by excess, so as to weaken the reproductive organs, incapacitating them for procreating strong, muscular and vigorous stock, thus planting disappointment and financial disaster.

The dairyman, in raising or purchasing his dairy stock, should be governed by the same laws that govern him in sowing or planting for a crop. Verily as you sow, so shall you reap. If you sow well developed seed, having the principle of vigor and strength within itself, in a rich and well prepared soil, by proper culture and protection, all other things being equal, you may reasonably expect to reap an abundant harvest, and be blessed in your basket and in your store.

MILK.

By Hiram A. Cutting, M. D., Secretary of Board.

It so happens that an article is produced by the operations of nature for the special purpose of sustaining life in the young mammal. This universal food is known as milk; and affords a typical illustration of a perfect natural food.

The egg stands also in a similar relation. All parts of the young chick are perfectly developed from it, and as it is shut up in a prison house, the shell, we cannot dispute but what all the material necessary for the skeleton, nerves, brain, sinews, beak and plumage are there combined, and further that there is a little cap for the beak as hard as adamant, which, enabling the chick with the feeble movements of his head to burst his prison house, then drops off as a useless thing. The chemist, it is true, finds too small an amount of mineral matter in the soft contents of the egg, but nature, more cunning than the chemist, draws the necessary amount from the shell, that it may be the more readily broken at the birth of the imprisoned bird.

Thus we can see where there is no possibility of an error, that nature can and does combine those products for the development and nutrition of animate beings.

Hence that such a combination is needed; and this conclusion from reason is fully proved by numerous experiments also. As the egg we know contains the necessary combination to develop the chick, so does milk furnish all that is necessary for the development of the young child or equally the young of any other mammal. It should constitute its sole food during the first period of infantile life, as it not only contains the exact principles required for the proper growth of the body, but it contains them in such form as to be especially adapted to the digestive powers then existing. It must be remembered that the exercise of the digestive organs only come into use after birth. That at the time of birth they are in an immature state, and it is only after exercise that their powers are made useful. In the child, during the first few months, no saliva is secreted, yet this is not necessary for the digestion of milk; is absolutely so if they are to digest other foods. It is only when their teeth appear that the pancreatic glands are formed; yet it is believed that no particle of starch or fat can be fully digested without pancreatic juices. Hence all starchy substances which are so often fed children early in life are no more digestible in their stomachs than road dust or cast iron would be in ours. Besides the alimentary canal is equally immature and exceedingly sensitive to every foreign substance. Is it at all strange that Registration reports in Europe, if not of our own State, should

show that one-fifth of all children born die before they are one year old, and one-third under five years? This shows more conclusively than we wish, that starch and other substances should never be employed as articles of food, until, by the appearance of the teeth and gastric juices, we are informed by nature that something more than milk is required.

Some enquire how they may know when this secretion commences, as the teeth are sometimes delayed. Children shed no tears before the third or fourth month as a rule, and after the tears are abundant, the saliva is formed, slowly at first, but as the teeth appear, quite abundantly, and as the pancreas develops at same time, starchy or farinaceous diet is admissable, but in small amount, to be gradually increased as seems best. Meats, as a rule, should not be fed for several months longer. But you will ask what I would do with the child that from any cause was deprived of the milk of its mother, as I have shown that nothing but milk will judiciously answer this purpose. To answer this, let us examine the milk, as a chemist, and see of what it is composed. We find different kinds of milk to be made up of the following ingredients, as analyzed and tabulated by Vernois:

	Specific Gravity.	1000 parts contain		The solid parts consists of			
		Fluids.	Solids.	Sugar.	Butter.	Casein and Extract's.	Salts.
Woman......	1032.67	889.08	110.92	43.64	26.66	39.24	1.38
Cow.........	1033.38	864.06	135.94	38,03	36.12	55.15	6.64
Ass..........	1034.57	890.12	109.88	50.46	18.53	35.65	5.24
Goat.........	1033.53	844.90	115.10	36.91	56.87	55.14	6.18
Ewe.........	1040.98	832.32	167.68	39.43	54.31	69.78	7.16
Mare........	1043.68	896.10	103.90	54.93	3.17	36.10	9.70
Bitch........	1039.17	863.07	136.93	58.43	23.11	50.47	4.92
Sow..	1042.38	818.80	181.20	46.00	55.60	70.00	9.60

From this table it will be seen that the milk of

	Water.	Sugar.	Butter.	Casein.
Woman contains........................	88	43	26	39
The cow "	86	38	36	55

Thus it will be noticed that the difference is slight, a little less sugar and a little more fat, so if the child is fed upon cow's milk it is reasonable to suppose that the result would be a fleshy baby. And such is true. To prevent this it is the habit of many mothers to make the milk half or more water at the risk of deranging digestion, and physicians often concur in it, believing that the curd formed is more likely to be in small floccular pieces as is the case with woman's milk. Dr. Hiram Corson was one of the first to discourage this practice, as he found often that children were starving on this watered milk, and that its digestion was impeded instead of being aided. Experiment has shown that pure milk from a cow, that came in milk at the birth of the child, and the babe fed regular without change of cows is in reality the next best for them to the milk of the mother. Some add a small amount of granulated sugar, (never brown sngar,) which

doubtless does no harm and may do good. The milk of the mother is always alkaline. The cow at grass produces alkaline milk also; but if stall fed, there is slight acidity, which will cause it to produce indigestible lumps of curd. In such cases a little lime water should be added. A furred tongue, with whitish curd scattered over it, indicates the condition in which lime water is desirable. Aphthæ or thrush in the mouth, frequently results from sheer starvation or neglect, and a white furred tongue is indicative of fever, and should alarm the parents that a physician be called. As the child with its delicate organs matures, its eyes at first without sight, gradually gain power and knowledge, and turn with affection upon the mother. Tears have put in an appearance and they are always welcome, as they show that nature is doing its work surely and well. The saliva and gastric juices are secreted, the teeth appear, and digestion is strengthened by the pancreatic juices, bringing capability of digesting farinaceous food. For some weeks the child has desired cold water, which should be given as wanted. Now the food is mixed with the saliva which contains an active principle that assists the conversion of the starch into glucose or grape sugar, which passes the stomach with the fats undigested, to be changed by the pancreatic juices into glucose, which being taken up by ducts prepared for the purpose, in circulation, passes through the liver as liver sugar to the lungs, where it as nitrogenous material is brought in contact with the oxygen of the atmosphere and oxidized or burned, giving animal heat which sustains life. Though the exact manner in which this is accomplished is a subject of argument, the results are apparent and certain, so you can all see how important a part the proper feeding of infants play in the development of their stature and mind as well.

The lesson here given shows the care necessary to render the raising of motherless animals in a herd a success.

Yet the cow's milk is a fair substitute, except with the colt. The milk of the mare as will be seen by the table does not contain as much butter as other milk. In fine, it is impossible to skim cow's milk close enough to allow of its being fed to the colt without first being watered. So it becomes necessary to skim the cow's milk as much as possible; add one-third water and a little sugar, and you can raise a colt that would have died in three days on common cow's milk, as the stomach could not digest the fatty material in it.

But I believe these hints sufficient; but to make it stronger I will quote a line or two from various authors of note:

Liebig says, "It is no mistake, but a fact, that the usual farinaceous foods are the causes of most of the diseases, and of half the cases of death among all the babes, in the country as well as in all large towns."

Zimmermann says, "I know very well that millions of infants are fed with pap, but I know also that it has killed many hundreds of thousands of them."

Dr. Eustace Smith, author of "The Wasting Diseases of Infants and Children," and one of the best authorities on the treatment of infants, says, "There is another class of cases where nutrition is equally unsatisfactory, although the supply of food, as food, is liberal

enough, but being farinaceous it cannot be digested by the young child."

Dr. Routh, author of "Infant Feeding, and its Influence on Life," says, "In very young infants starch is not digestible as such; it does not appear to find material for its conversion into digestible sugar; yet how frequently, and even by medical men, is arrowroot ordered in cases of diarrhœa as the exclusive diet. I cannot conceive anything more injurious than this popular arrowroot feeding. I believe it is a cause of death of many infants."

Dr. Prospero Sonsino says, "Starchy matters cannot be well digested in infancy, and there is really in infancy what may be called a *physiological dyspepsia for starchy aliments*."

Dr. Grinnell, Professor in the medical college in Burlington, says, "We often see infants fed on corn starch, farina and other substances, all containing starch, which can never be digested by the infantile stomach."

MEDICAL PROPERTIES.

Few remedies are more important than milk for the sick, considered either as food or medicine. In the former capacity its easy digestibility, nutritious character, and entire want of stimulant or irritant properties render it very useful as an article of diet in many cases of chronic irritation, or inflammation of the alimentary mucous membrane, in chronic diarrhœa, dysentery or gastritis. In such chronic cases I have often seen it effect cures, as an exclusive diet, with but little aid from medicine. In vomiting, where the stomach contains little or nothing for days, weeks, and even months, cures are often effected by this simple treatment, with perhaps the addition of one-fourth lime water to the milk, which does not injure its taste.

As before stated, milk contains all the principles necessary for the support of the human body. Hence, it is applicable to many cases in which there is diseased blood, caused by errors in eating rich food. In some febrile cases, especially enteric fever, it is very valuable as a diet.

It is also a remedy of great value in nausea and vomiting, especially when combined with lime water, in doses of a table spoonful an hour or oftener. Hospitals have been established where a milk diet was their only medication, and the result has been such as to justify the statement that it is indeed more valuable than any other one thing in the treatment of disease, as some results have been truly wonderful.

ADULTERATED MILK.

Like all other substances the cupidity of man has found methods whereby he can adulterate milk, and thus gain money faster than he could by honesty. His excuse is that others do it, and compete in price, so he must do the same or be crowded out of business. Of course this is usually done with water, though magnesia or chalk are sometimes added to keep up its white color. The instrument in common use to detect this fraud is the lactometer, which gives its specific gravity. The specific gravity of distilled water, which is the standard,

is 1,000, and average milk, 1,033, but the cream is lighter than water; so by the removal of cream the specific gravity is increased to, say, 1,035; now by adding water, which is lighter than milk, but not as light as cream, the specific gravity will at length reach 1,033, as at first, but the rogue has taken the cream and substituted water; hence this instrument has been a premium on rascality. For this reason test tubes, in which the thickness of raised cream could be ascertained, have been used as a check on the dishonest practices of those that would evade the specific gravity test, yet are not wholly satisfactory, as the cream rises much quicker and more perfectly on watered milk. So if the cupidity of the dishonest vendor did not go too far, he escaped detection then. At length the ingenuity of some one brought out an instrument that consists of a piece of vulcanite, with a glass cover, around the edges of which are painted a band of colors, from near white to grey. By placing a few drops of milk on this vulcanite, and pressing the cover down upon it, the shade of black from the vulcanite is dependent upon the richness of the milk, as the poorer it is the more the black shows through. While no one can tell whether the milk has been watered by this instrument, he can tell whether it is good or poor, and hence it is a valuable aid in selecting cows. Various other devices have also been used, but all are imperfect and an unsatisfactory safeguard against adulteration.

FLUIDS.

As we see by the table, about eighty-six per cent. of milk is water, holding the sugar and salt in solution, and the cream in emulsion, yet allowing quite a portion to separate, thus giving us the cream, which is so valuable for butter.

THE SOLIDS

Are what would be left after evaporating all the water, and we will treat them separately.

THE BUTTER PRODUCT.

In this opaque, white liquid, consisting of water, casein, albumen, sugar (lactine), lactic acid and salts, is an oil which, when properly prepared, we call butter.

This oil, when examined, by the microscope, is found to float in the liquid, giving it the character of an emulsion resembling that produced when the pulp of the almond is mixed with water; and those oil globules, in considerable part, produce the opaque quality of the milk. They are remarkable for their perfect sphericity as well as for the brightness of their middle portions in contrast with their dark circumference, an optical effect, depending, probably, on the refractive power of the oil which appears to be contained in a transparent membrane, and was long supposed thus to be, but more perfect instruments, together with the fact that the cases are never seen, even the least fragment of them, leads us to suppose that these cases do not exist, and those recent examiners most entitled to credit discard the theory of their

existence altogether. These oil globules vary from one-nine hundredth to one-twenty-five hundredths of an inch in diameter.

When milk is allowed to stand, it separates spontaneously into two portions. The oil globules, by reason of their lower specific gravity, collect upon the surface, forming cream. The richness of milk is determined by the relative thickness of this cream, and that this may be accurately determined, a graduated test tube, called the lactometer, has been brought into use, much to the advantage of the farmer in selecting his best cows. Yet, in the selection of a dairy, more than this is required, for the dairyman wants not only the cows that produce the most cream, but the cows that have a uniform oil globule, not only in the cream of their own milk, but with the whole herd. This is one reason why the Jersey stands at the head as a butter cow, because, through the entire breed, the oil globule is large and uniform. The cow that makes butter that is little affected with heat, or does not melt down, as the saying is, has a large and uniform oil globule, and for this reason the Jersey has no superior. Not only the casein and sugar are subject to great fluctuation, but the amount of oil also, according to the state of health and the substances on which the cow is fed. The milk not only takes its flavor from the food, but is often the source of elimination of noxious substances which are taken in the food, so the flavor of the milk and cream change continually with the food and water that the cow drinks, thus showing the care necessary to render the butter product first-class.

In my experiments I have ascertained further, that where there is a large amount of cream, with a large oil globule, that the milk absorbs or takes in odors more readily when drawn in tainted stables, or left to stand in impure air. Hence the Jersey cow, to make the best butter, requires more careful attention than the Holstein or Dutch cow, which really produces the smallest oil globule of any breed, yet some produce very rich milk, but the cream, measured inch by inch in the lactometer, does not make as much butter, as it is not so perfectly separated from the milk as larger globules are. I once had a Holstein cow that gave a very rich milk, and I experimented with her for five years. At some times the milk was fully half cream. It did not make good butter. It required a long time to churn it, and it was white and soft. It was excellent milk for cheese, but one such cow in a butter dairy would injure the whole dairy product, as I believe. From this can be seen the necessity of sorting the cows according to the size of the globules. This cow had the smallest I ever saw. The Holsteins, as a rule, give the most milk, but the average analysis of ten samples gave results as follows:

	Water.	Fat.	Casein.	Sugar.	Ash.
Holstein	87.34	3.85	4.78	4.20	.40
Jersey	83.48	8.17	4.08	3.53	.71

The quality of the butter depends much upon the churning, and as the fat globule is always the largest when the cow is about one month in milk, and decreases afterwards, and may be no more than half the size when farrow, it follows that a farrow cow in a dairy is as bad as

a Holstein with Jerseys, and most farmers understand that her milk, with other cows that are just in, retards the churning ; and he would find also, if he churned the cream separate, that in a dairy of eight cows he would many times get more butter to keep the milk of the farrow cow out than he does with it in. The quality is also improved. When pastures are short, and cows are forced to eat weeds, leaves and twigs of trees, swamp grasses, &c., which injure the quality of the butter, it will then require much longer time to churn. When this is the case, the cow may be given a teaspoonful of common soda four times a weck, and a teaspoonful of saltpeter once a week, with advantage.

OLEOMARGARINE.

There has been so much said about this artificial butter that I give the process of manufacture, the points of which I learned through the courtesy of Dr. Henry A. Mott, Jr., of New York. There are poor grades of this product, though I describe the best. There are also lardines and other products in which cotton-seed oil and lard are used, but which fall far below this product in my estimation, and this is not equal to butter, though it comes nearer to it than any other product, and comes most in competition with it.

FAT AND WASHING.

The fat comes in in early morning, about daylight, from the butchers, and consists of the leaf and clean fats from slaughtered beeves. On arriving at the factory, it is first weighed, and then thrown piece bv piece into large tanks containing tepid water, care being taken to place all pieces covered with blood in a separate tank to be washed. The fat in the tanks is covered entirely with tepid water, and left at rest for about one hour, when the tepid water is removed and the fat thoroughly washed with cold water, then covered with fresh cold water and allowed to rest for one hour longer ; the water is then again removed, and the fat thoroughly washed, for the last time, with fresh cold water, when it is ready for the next operation.

THE DISINTEGRATING PROCESS.

This consists in disintegrating the fat by passing it through a "meat hasher." To do this, the fat in the tank is removed by means of a wooden car to the side of the hasher, where it is cut with a knife into pieces about five or six inches square. Piece by piece it is introduced into the hasher, which, by means of the revolving knives within, cuts the fat very fine and forces it through a fine sieve at the opposite end, and finally out of the machine and into a tub.

MELTING PROCESS.

The fat, now in a disintegrated state, is removed to the melting tank, care being taken not to introduce into the tank any of the water which is forced out of the fat during the disintegrating process. The

fat is then heated by means of the water surrounding the tank, until the temperature reaches 116° F., when the steam which heats the water is turned off. The water surrounding the tank being much warmer then the molten fat, increases the temperature of the fat to about 122° to 124° F., when the fat completely melts. During the whole operation, from the time the steam is turned on until the melted fat is allowed to rest, the fat must be continually stirred, so that an even temperature may be maintained. The adipose membrane of the fat, called "scrap," separates and settles to the bottom, on leaving the melted fat at rest, and a clear yellow oil floats on top, covered by a film of white emulsion of oil with the water contained in the fat.

When the scrap has completely settled, the thin layer of emulsion is skimmed off, and the clean yellow oil is drawn and received in wooden cars, which, when filled to within one inch of the top, are removed to some place to allow the oil to granulate.

PRESS PROCESS.

The car containing the solidified oil from the melting process is removed to the press room, which room is kept at a temperature between 80° F. and 90° F.

The refined fat must not be so solid that it cannot be worked with the fingers with ease; if it is, it must be left in the press room until it softens. When in the right condition, it is packed in cloths, set in moulds to form packages about four inches wide, eight inches long, and one and one-half inch thick. These packages are then placed on galvanized iron plates in the press, at equal distances apart. The plates are piled one above the other until the press is entirely filled, when the packages are subjected to a slight pressure, which must be increased very gradually, and only after the oil pressed out begins to flow very slowly. The oil is received in a tin vessel, which, when filled, is replaced by another. The pressing is continued until no more oil can be obtained at the temperature of the room. The pressure is then removed and the plates unpacked, when cakes of pure white stearine are obtained, having the dimensions of about eight inches by five inches by one-fourth inch. The stearine, after the removal of the cloths, is ready for sale.

The oil obtained from the press is removed to some cool place, until it assumes a temperature of about 70° F., when it is ready for the next operation.

CHURNING PROCESS.

The oil now at the proper temperature (70° F.) is removed to the churning room. One hundred pounds of oil are introduced into the churn at a time, with from fifteen to twenty pounds of sour milk. About three or two and one-half ounces of solution of annatto, to which has been added from one-half to three-fourths of an ounce of bicarbonate of soda, is now to be added, and the whole agitated for about ten or fifteen minutes, until milk, coloring matter, and oil are thoroughly mixed together, when the whole mixture is withdrawn from

the churn, through a hole at one end, and allowed to fall into a tub containing pounded ice. As the oil flows on the ice, it must be kept in constant motion until the tub is filled with solidified oil, when another tub is put in its place. Crystallization is by this simple process completely prevented. The solidified oil, which has a slight orange color, is left about two or three hours in contact with the ice in the tub, when it is dumped on an inclined table, where it is crumbled up so that the ice may melt and leave the solidified oil, which is then crumbled up fine by hand, and about thirty pounds of it at a time are introduced into a churn, with about twenty to twenty-five pounds of churned sour milk, and the whole agitated for about fifteen minutes, when the solidified oil takes up a certain percentage of the milk, as also the flavor and odor (which were by the ice washed out from the first churning), and pure butter is produced. This is now removed from the churn to the working table, where, after standing and draining for a time, it is salted, to the extent of three-fourths to one ounce of salt to the pound of butter.

After proper working and standing for a sufficient length of time, it is packed into firkins, and is ready for sale. The butter thus produced contains nothing foreign to the very best of butter. When prepared as above, it has always found a ready sale in the market, as its keeping qualities are far superior to butter made by churning milk or cream. The percentage of butyrine, caprine, caproine, etc., it contains is very small (being derived from the milk in the last churning process), not sufficient to make the butter become rancid when decomposed, but quite sufficient to give to the butter the so-much prized flavor and odor.

A sample of butter, made by the above process, was sent to the Hon. X. A. Willard, then President of the New York State Dairymen's Association, and considered one of the highest authorities in this country on everything connected with dairy products. He says, in a letter on the subject: "The sample of butter sent is far superior to any artificial butter I have seen, in flavor and texture. I have shown it to a number of experts in butter and they were greatly surprised at its flavor. If it could be made of a more waxy texture it would puzzle some to distinguish it from the genuine article."

I here give complete analysis of true butter and this artificial product, made by Dr. Brown and Dr. Mott, and which I believe correct:

CONSTITUENTS.	Natural butter.	Artificial butter, when properly made.
Water	11.827	12.005
Butter—solids	88.173	87.995
	100.000	100.000
Palmitin ($C_{51} H_{98} O_6$)	16.826	18.307
Stearin ($C_{57} H_{110} O_6$)	35.399	38.502
Olein ($C_{57} H_{104} O_6$)	22.934	24.954
Butyrin ($C_{15} H_{26} O_6$) Caproin ($C_{21} H_{38} O_6$) Caprin ($C_{33} H_{62} O_6$) Caprylin ($C_{27} H_{50} O_6$)	7.606	.262
Casein	.183	.745
Sodic Chloride (Salt)	5.225	5.225
Coloring matter	......	Trace.
	88.173	87.995

By comparing the constituents of these two analyses, it will at once be seen that the difference in the per cent. of the different constituents arises from the very small amount of butyrine, etc., in the artificial product, and it is for this reason that the artificial butter keeps so much better than natural butter. There is sufficient of the butyrine in the butter to give it the odor, flavor, and somewhat the taste of butter, but not sufficient, when decomposed into butyric acid, to render the product rancid.

It will be noticed, also, that all the volatile fats stated are calculated as butyrin; but Heintz has discovered two others, butin and myristin, which are also there included, making 7.344 per cent. more of those volatile fats, so capable of change in the real butter, yet it is to them that the true excellence and splendid flavor of butter is indebted.

CASEIN.

This term is applied to the coagulable principle of milk. It is this that forms cheese. A similar substance is often found in blood and in the pancreatic juices of the ox and sheep; it occurs also in vegetables. The casein of milk is precipitated by rennet, acetic acid, sulphate of copper and various other mineral and earthy salts. Hence milk may be used as an antidote in poisoning with many metallic salts, as the compound formed is not easily soluble.

Casein is contained abundantly in peas, beans and the seeds of leguminous plants where it is associated with starch. It may be easily obtained by digesting coarsely powdered peas in cold or tepid water for two hours, allow the starch to subside and then filter the liquid. This will be a clear, viscid solution, and the casein can be precipitated by acetic acid. The Chinese make cheese in this way

instead of from milk. The fact that it is coagulated by rennet as in the process of cheese making, is also one of its distinctive characteristics.

The casein of vegetables seems the same as from milk, though it is often called legumine when the vegetable alone is spoken of. It contains sulphur and phosphate of lime. It has been found by experiment that the best temperature for curd to be produced by the use of rennet is from seventy-seven to eighty-six degrees, it being at the same time agitated. If not as hot it does not become firm ; if hotter, it is too hard or leathery. Most excellent cheese are made from milk where the cream has been removed by the centrifugal process, and doubtless that method will soon supercede the old, much to the advantage of the dairyman.

LACTOSE, OR MILK SUGAR.

$C_{12} H_{22} O_{11}$.

Lactose, an isomar of cane sugar, is found in the milk of all animals ; but only one plant in the known world produces it, and that is "Achras Sapota." Milk sugar is prepared by heating milk with rennet, separating the curd, filtering through animal charcoal, and then evaporating to the crystalizing point.

It occurs in commerce, generally, as elongated crystaline masses, containing one part water more than cane sugar, which is the real chemical difference. Milk sugar is easy of manufacture and would be produced extensively did the market demand it, but as it is, the sale is limited, and the market easily broken, so few attempt its manufacture, and those who do generally can concentrated milk also, so that this business may be continuous.

It can easily be made by any one desiring to do so by evaporating clear whey in an ordinary manner. Yet the sugar thus obtained will not be clear and white enough for market.

SALTS.

The salts or saline matters in milk amount to about one per cent. at most, and fall as low as one-fourth of one per cent. in extreme cases.

They consist of	Phosphate of Lime, about	0.37
"	Chloride of Iodine, about	0.14
"	Magnesia, about	0.07
"	Soda, about	0.04
"	Iron	a trace.
"	Phosphorous	"
"	Chloride of Potassium	"
"	Iodide of Potassium	"
"	Carbonic Acid	"

Those salts are not always all present, and sometimes others that come through the food, even poisons, are found, but the

CARE OF MILK

is one of the most delicate of all of the operations about the farm and that it may not be in any way contaminated, I will mention a few of the many ways in which milk, or its products, may be injured. Doubtless you have had trouble with the animal odor, or the odor of the stable. There are little scales thrown off from the skin of the udder that will give a bad taste. The best way to avoid this difficulty is to wash the udder before milking. Other odors are largely due to the piles of manure under the barn, which exhale great quantities of ammoniacal gas, and this is readily absorbed by the milk. If your stables are close, they ought to be thoroughly ventilated at least just before milking time. A better way is to have your stable well and thoroughly ventilated, so that the building will be as sweet as the house, and there will be no odors to contaminate the milk. To free milk from such contamination, I have made experimental use of ozone. Its use is hardly practicable by farmers at present. The best generator would be an electrical machine, and the dairymen and the butter consumers have not yet reached a point so high.

You can produce ozone by the action of strong sulphuric acid upon permanganate of potassium. It is only necessary to mix very gradually three parts of the acid with two parts of the salt, and this mixture will not only give off ozone abundantly, but will not cease to give it off for months. You will at once see that in this way it can be introduced into any house or stable, and it not only takes away all offensive odor, but gives a flavor fine and delicate, beyond anything we yet know of.

Another but an inferior way is to ærate the milk. Take a large tin pail, punch a number of small holes in the lower edge around the bottom, hang this up ten or fifteen inches from the pan, and strain the milk through it. This must be done in a sweet, pure atmosphere, or the difficulty will be increased rather than diminished.

Charles H. Cole of Lunenburgh built a fine new barn, perfect in every respect but in ventilation. The want of that (as he was a gilt edge butter maker) was a serious obstacle to success. He put in a ventilator; his milk became as good as ever. I, therefore, urge upon all the farmers of Vermont, the vital necessity of a thorough ventilation of their barns. Build high ventilating chimneys, and connect every stall with them. Don't be afraid of making them too large.

A Massachusetts man tried the experiment of setting birch branches around his milk room to keep off the sun, and it answered well until one day the odor of the birch penetrated the room, and the result was that the butter was affected by it. So, also, a man of my acquaintance had his milk room open while turnip and cabbage were being boiled in the kitchen, and the result was that the butter tasted of turnip and cabbage. These examples prove that too much care cannot be taken to keep undesirable odors away from the milk and the butter. Utensils not properly scalded, or scalded too much, affect the milk and butter unfavorably. The water you use in scalding must be boiling hot, otherwise the fungi and the spores that produce them are not destroyed.

Many use wooden milkpails, and I often see them put out doors, even hung on fence posts to dry, and they are allowed to remain through the heat of the day; as the pail dries many little season checks open on the inside of the staves, and fungi, so detrimental to good dairy products, creep in, as the spores are ever present in the atmosphere, and vegetating, ripen spores which contaminate the milk as it is drawn into the pails, and inferior butter or even poisonous cheese is the result.

Of late cheesemakers have become more careful, and I have heard of no cases of cheese-poisoning for sometime.

When the fungi greatly abound they give a blue tint to the milk, and of course injure it and the butter. As to tin pails, the fungi flourish in the crevices where the parts are joined. I urge you all to use only pressed tin pails. These have no such crevices, and the fungi can get no foothold in them.

There are farmers that do not take sufficient care in milking, so that their butter and cheese is tainted. I see cows in some parts of the State kept as clean and slick in the stable as in the June pasture. That is the best way to keep them, in spite of the trouble. Another point: I went into the milk rooms of a cheese factory not a hundred miles from here, and I felt the floor spring a little, and I saw mould in the cracks of the floor, and on looking closer I found maggots there also. Now it is not possible to get the best article of butter or cheese unless you get rid of all animal odors, and of these little blue fungi of which I have spoken. They are omnipresent. It is estimated that in a puff-ball there are no less than millions of spores; the smoke of the puff-ball is made up of aggregate thousands of these little spores. When the plant itself is microscopic, judge how much more infinitesimally these little germs may be scattered through the atmosphere. It is necessary that you should wage constant warfare against them. The cause of fermentation and putrifaction and kindred processes is a small microscopic plant. Hence, it is necessary at every turn of your life to guard against these minute things.

The manner and substance in feeding your cow is of great importance, especially the water which they drink. Many farmers allow their cows to go into swampy places and "soop" up the water from the ground. Would you like to drink there? Would you like to partake of feverish milk from an animal diseased by impure water? Whatever affects the physical condition of the cow affects the milk. There is a little animalcule that infests pork, the trichina; and many do not like to eat pork for that reason. But on account of drinking impure water there is a little worm, called the strongalous micrurus, which infests the cow, especially to the detriment of the milk. They increase in immense numbers and produce in the cow a feverish condition, which causes what is known as strong milk. It infests cattle in Vermont to a much greater extent than I had supposed. It affects their lungs, and prevents proper respiration. In this condition of the animal, milk is certainly not in its best condition. Now you that have these swampy places in your pastures, if you can't underdrain them, put fences around them, rather than expose your

cows to malaria by drinking from them. In winter I would give cows tepid water to drink, to prevent the shock resulting from drinking cold water. In the matter of feeding cotton-seed meal to stock, I would say that it may be used to advantage by dairymen in feeding old cows, but beware of feeding it to your calves or young cows. It will almost invariably kill the former, and produces intestinal diseases in the latter. Do not overfeed, when you use it. One quart is better than two.

It is said by some that it flavors the milk, and thus injures butter, and that ensilage does the same, but I have never detected the injury.

There is something worse, and that is tobacco. Never allow a man that smokes to milk your cows, or go near your milk room. If you do, the tobacco can be tasted in your butter. Remember I do not say while smoking, but if he smokes his clothes are tainted, and your milk and its products are injured.

Some build hog pens near their milk rooms for the convenience of feeding. There was never a more fatal mistake. Have no bad smells that can ever find entrance to your milk room, as the profit is high prices, and they do not go together. What your cows breathe also affects them. If you don't believe it, put some chopped onions in front of your cow, but beyond her reach, and see how strong your milk tastes of them.

F. D. Douglass had his butter injured by the unburied carrion of a neighbor, the smell of which was wafted across his pasture. After having taken all pains in this direction, let us look in another. Cold below forty-five degrees is injurious to milk, butter or cheese. Never let ice touch your butter, or be put in your milk, and never let the temperature of any product or the milk itself get above seventy degrees. A greater heat is injurious.

To the dairymen, I would say, that constant care and constant investigation must go hand in hand, and keep pace with the refined tastes of the wealthy, as that sense is capable of being educated to almost any extent, and it is this educated sense you wish to please, as in that lies your profit.

May success attend you.

SETTING OUT AN APPLE ORCHARD.

BY T. H. HOSKINS, M. D.

SELECTING THE SITES.

In locating the spot for an orchard the farmer is necessarily more or less controlled by circumstances. As a rule it is desirable to have the orchard near the dwelling, not only for convenience, but for the safety of the crop. This is especially the case when the orchard is not to be a large one, and is planted chiefly for family use. A large commercial orchard the owner can afford to protect, if necessary, by a night watch, but a small one at a distance from the house may be, and in most localities would be, sure to be stripped of its fruit before maturity, and so become a source of vexation in place of profit.

Though there are good orchards with every aspect, yet as a rule a northern or eastern slope is always preferable (other things being equal) to a southern or western one. The reason for this is that the heat of the winter's sun is more apt to start the sap in the warmer than in the cooler exposure. This rising of the sap in winter is often the cause of great injury to the trees. Yet I would not plant an orchard on unsuitable soil in order to obtain the best aspect, nor even in an inconvenient locality. The evil of the southerly and westerly exposure may be almost entirely counteracted by slanting the young tree at an angle of ten or twelve degrees towards the sun's position at two o'clock, or somewhat west of south. If the prevailing winds of summer are southwesterly, the slant may be made as much as fifteen degrees, as such a wind has a tendency to overcome this slant and restore the tree to an erect position. It is only while a tree is in leaf and growing that the wind can permanently deflect it.

The quality and physical condition of the soil are important elements in deciding upon the location of an orchard. Perviousness to moisture and to the roots of the trees is of the first importance. I have seen very fine orchards, to all appearance, when young, come to naught before maturity because planted over a ledge of rock with only two or three feet of soil upon it. But an orchard planted in a hard impervious soil, or over an impenetrable "hard pan," will never look well at any time, or ever be of any value to the owner. A good orchard can be grown upon a pretty strong clay, or clay loam, if fertile and well underdrained, either naturally or artificially. In fact, for many of the best market varieties of winter fruit, a rich clay loam so situated or prepared is the best of all soils. But of all things hope-

lessly destructive to fruit-trees, to plant them in hard, poor ground with a water-tight and "poisonous" subsoil is the worst.

There should also be good surface drainage all over the piece selected for an orchard. An apple-tree has no objection to moisture; on the contrary it likes it, but not stagnant moisture, even for a day. I have seen men put the roots of young apple trees into a tub of water until they got ready to set them out, and find that after being so left for four or five days not one of them would grow. It is often the case that an apple tree planted in a depression where the surface water will settle around it, and be retained by the frost in the ground below, will be killed. The wood of such trees appears green, and cions cut from them will grow, but they never fully leaf out, because their roots are dead from water-soaking. One of the very best places for an orchard that I ever saw, where the trees grow the thriftiest and bear the fullest and most regularly, is a rich rocky hillside with clear springs breaking out all among the trees. The water from the springs runs over and among the apple roots in all directions without injury. Why stagnant water kills and running water benefits an appletree I leave to others to explain, but such are the facts.

PREPARING THE GROUND.

Some ground needs no preparation at all. The hillside orchard spoken of above was planted amongst the green stumps of a new clearing, never had any tillage, and has always been in the grass. In Maine there are hundreds of fine orchards upon land so rocky that it would be impossible to run a plough two rods in it anywhere. It is quite a job just to dig the holes for an orchard in such spots, and entirely out of the question to have the rows regular, since if so laid out the location for more than half the trees would come on top of a rock. They have to be "stuck in" anywhere, the only precaution being not to get them too near together. But the land is strong and full of food for trees, and the crops of fruit are often wonderful. On moderately level land it is open to the planter to till his orchard ground, both for the benefit of the trees and for the purpose of obtaining other crops while they are small. This is my own practice in a considerable part of my orchard; while I have many trees set upon slopes where the soil would wash fearfully if it were not kept in grass. The latter, when all the grass is used around the trees as mulch, grow quite as fast as those in the tilled ground, and suffer far less from the accidents of our severe winters; but of course there is no revenue from the land until the trees commence bearing. Premising that only good land in good condition should be chosen for an orchard, the only thing I should say about preparation would be that the surface drainage should be carefully attended to. In the case of good land in poor condition, I would certainly advise that it be well enriched before planting the trees, and the best and most permanent enrichment I know of is to fill the ground, to the extent of at least one ton to the acre, with coarse ground raw bone. On light soils, or those known to be deficient in potash, add a liberal dressing of ashes or the potash salts.

Bone and ashes are far preferable to stable manure for enriching orchard ground, according to my experience.

SELECTING THE TREES.

If possible, the intending orchardist should go to the nursery with his own team after his trees. A near nursery, if competently conducted, is preferable to a distant one for this reason alone, but still more because the nurseryman can give most important information in regard to the local value of different varieties. I have been (but am not now) a nurseryman for many years, and I know that my advice to my customers in regard to the choice of varieties, when taken, has far more than doubled to them the value of their purchases. When going for trees, carry plenty of old blankets, carpets, or other suitable covering to protect the trees from sun and wind, and straw to keep them from chafing. Also take a water pail along, and if the distance is long wet the trees thoroughly once an hour until you get them home. It is best not to go for trees until the holes are dug, but at any rate, keep all the trees well shaded and moist, and if more than a day's delay is necessary, dig holes and bury the roots carefully (working the soil amongst them) until ready to plant them.

In my experience nearly every purchaser who goes to the nursery will be very anxious to get straight, tall and large trees. These qualities in a young tree are more or less desirable, but they ought not to be allowed to determine the choice entirely. Some of the best growers in the nursery are very poor sorts for the orchard. This is one reason why peddlers' trees are mostly made up of inferior sorts, no matter how they may be labelled. When they go to the nursery for their stock they insist upon such as will, in their language, "deliver well," and they will take crab-apples or anything else that is tall, straight and handsome, rather than choose the best varieties that do not make shapely trees in the nursery. They find it far easier to satisfy their customers with the shapely trees, and one kind of label costs no more than another. Unless the purchaser can depend upon the advice of the nurseryman in this matter, it is best not to buy of him at all. Relying upon the nurseryman in this, the chief points which the unskilled buyer can judge about for himself are, that the young tree shall have plenty of roots, that the bark has a bright healthy look, and is free from bark-lice, and that the young tree has its branches well placed—not crotched—and not too numerous. Be not too anxious for *large* trees, but select rather the best you can find among those not more than three or four years old, younger rather than older. My own choice now is a straight, strong, thrifty young tree one year from the bud or two years from the root-graft, without branches. Then I can shape it in the orchard to suit myself. In some parts of the country, especially in Maine, it is the general practice to buy only seedling trees, three or four years old, from the nursery, and to top-graft them with the kinds desired two or three years after planting them in the orchard. Where it is desired to grow sorts rather tender for the climate, as the Baldwin is in Maine, this is a very good way. It ensures a healthy trunk and much longer life

to the tree. In case there is no good nursery accessible, the best way for beginners is to consult with experienced orchardists in their own neighborhood, and take their advice about the best place to obtain trees.

PLANTING THEM OUT.

It is perhaps rather dangerous to advise anything that may appear like indifference or carelessness in the planting of a fruit tree. Even if some unnecessary work is done about it, the extra cost is but a trifle compared with the value of a good job. But it has always seemed to me that a great deal of humbug has been incorporated in the teaching of writers in regard to the setting out of trees. The essentials, as I have found them, are: 1. Have a good tree, well dug, with plenty of good roots not injured in transportation. 2. Have the holes dug large enough, so that these good roots can lie out straight to their full length, and deep enough, so that when the setting is finished the tree shall be just as deep in the ground as it was before. 3. Trim all bruised and jagged ends of roots by an undercut with a sharp knife. 4. Have the dirt in the bottom of the hole highest under the stem of the tree, so that the roots shall slope naturally downwards. 5. Have the man who is holding the tree hold up also the upper tier of roots while the lower ones are being carefully planted by pressing soil firmly to and among them. The ends of the fingers held together and used like a wedge to pack the fine dirt firmly among and around the roots, make the best tool for this work, taking down layer after layer of roots until all are thus planted. 6. Use no manure, muck, compost or woods dirt among the roots, because it soon decays and leaves a cavity injurious to the tree. Do the planting entirely with earth. 7. Trees not too large from the nursery, and with good roots, properly set out, will never need any staking; but if tall, with short roots, they must be staked, using a strong soft band wound once around the tree and tied firmly to the stake.

Newport, Vt., June, 1884.

SEEDING TO GRASS.

Address delivered by Capt. C. E. Abell at the State Board of Agriculture, Orwell, Vt.

Mr. President, Ladies and Gentlemen:

The secretary of our club has assigned to me (as you notice on the programme,) a rather *seedy* subject.

I comply with his request because it is a subject of vast importance, trusting that what I may say may "trouble the waters" and that we may derive much substantial good from remarks which may follow, coming from eminent practical farmers who know what they are talking about.

Yesterday we learned what it is possible for a single cow to do in the butter-way. But a farmer knows that eight hundred pounds of butter cannot be made from a given quantity of bones covered by a yellow skin alone. Something else is required, feed. Now our cattle can no more get along without their hay for a basis of feed, than a Dutchman can without his saur-krout or lager beer. Hay, then, is the basis of feed; the other part is governed by the height of the fancy, or the depth of the pocket.

The piece I read to you this morning is in reference to its growth. It has one merit which you all can appreciate, namely, that of brevity.

It has been but a few years since it was the generally accepted idea that "our clay lands were made right side up." Our fathers told us that was, undoubtedly, the original design of the creator; that they had sometimes tried to improve certain pieces of such land by plowing, but the result was the same as it was with those who "put new cloth into old garments," it was made worse. They were suspicious by the way clay acted, whenever they wished to do anything with it, that the very devil was in it; they *positively knew* the simple act of turning it over begat the bluest kind of profanity. Hence it was better for the spiritual as well as for the temporal welfare of the farmers, to let the clay remain in its first position, plow what loam they had (if they had any) and, trusting to Divine Providence, pull the year around some way or another.

But our meadows had been cut over for sixty, seventy, or eighty years. A new kind of grass was coming in, that, when cut, amounted to nothing. Hay stacks were few and far between.

Our barns lightened low to the passer-by when they should have been full. Flocks and herds dwindled year after year, until John told the old man, "Father, something must be did; we must plow, starve or emigrate." They plowed, and at harvest time the old man, as he viewed with infinite pleasure the bountiful crop before him, did not, like Pythagoras of old, rush through the street shouting "Eureka," but with eyes beaming with satisfaction and delight, exclaimed, "Gorry, John, who'd a thought it!" He had almost for-

gotten that the old wooden plow had been laid aside for the shining steel, and the old A drag with its eleven or thirteen teeth had given place to the discs of the pulverizer. But so it was, and the question as to the feasibility of cultivating clay lands was settled beyond dispute.

That, then, which concerns us most, is the best way of seeding our meadows to grass again when we have commenced their cultivation. The greatest bane to our clay meadows for the past few years is the white grass, or which I think is more properly called sedge grass. I think it originally came from the south, (the seed having been brought here by migratory birds) where it grows upon old cotton plantations that have been "laid up to rest." There is one thing about that grass when made into hay, that strikes every one, who has any of it, as peculiar; it is this, that its value is estimated according to the same law which in physics governs refracted rays of light in the inverse ratio of the square of the number of tons he has secured. This grass will be green and thrifty on the 25th of June, and by the evening of the 26th it will be as dead as an Egyptian mummy, and the seed scattered on the ground.

And now, to destroy this grass, and put the seed where it will be least liable to trouble us, we must resort to plowing. And it is just here that the first step toward seeding down land is taken, and it is absolutely necessary that this initial movement be taken well, every furrow should be cut as truly as possible and without a break. I think five or six inches deep enough and sufficiently shallow; this will make a good, deep seed bed, the soil beneath retaining moisture better than if nearer the surface. When possible, I would commence on one side of the field and plow continuously as far as I wished.

The situation of the land should be considered, plowing so that water will not remain on the land more than can be well helped, but may plow freely away between the inverted sod and the subsoil. I am inclined to think that a good swivel plow is the best for this purpose, in most places avoiding dead furrows on inclining lands, cutting the furrows up and down the hill. The land being less liable to gully and the sedge will not come into the field as soon, for it is almost impossible to destroy it along the sides of the dead furrows. I would hardly ever plow around a piece of land.

Clay lands should be plowed in the fall to be subject to the action of the frost. As far as my experience goes spring seeding produces the most favorable results. In order to get a good catch the field should be top dressed with at least twenty-five loads of good manure, pulverized and worked into the soil with the greatest care; this ought to produce three tons of hay per acre at the first cutting, and may be called a success. Before sowing the grass seed, I should put in oats or wheat, which are needed to prevent the small grass plants from being destroyed by the summer sun. If the grass seed is sown with oats, I would not put more than two and one-half bushels of oats on an acre. Some times we may wish to raise two crops from the field before seeding to grass, the first, perhaps, a piece of corn. I would not plow the land if clay the second time, but mellow it the following spring with a wheel harrow and proceed as I have stated on sod ground.

I think that clay lands take more kindly to wire worms than corn. I have tried it the past two years, and according to my best calculation, I have raised on average about 637½ bushels of wire worms to the acre. I don't need them, and the only way I can devise to get rid of them, (all other remedies have failed) is to bet high that I can raise that crop again, and by some process of evolution they will change into something else that I don't have any particular friendship for.

What to seed with is a question to be well considered. That depends much on the character and situation of the land. If on loam or high clay soil I should sow timothy and red clover, on moist land the same with alsike clover, on muck or swampy places the three kinds with red-top or foul-meadow grass seed. I would put in clover every time. Clover is the surest to catch of anything except daisies. Twelve quarts of timothy and clover seed are sufficient for an acre if well distributed. Grass seed may be sown directly after putting in the grain and rolled or harrowed in very lightly.

If it is not convenient to sow at that time, sow any time (but sooner the better) perhaps before a shower or on a rainy day. The rain will almost always cover it sufficiently.

In seeding lands there are no specific rules by which we can be governed under all conditions. If there is any secret in raising grass it is the careful preparation of the land, making up what is wanting in the natural soil by a generous application of manure. Do not hurry or neglect any part of it because you wish to finish your work before your neighbor has his, and in every part of the work use as much good sense as you have to spare. That is about all there is to it. While I freely admit that I might, with much profit, take an occasional dose of my own medicine, I believe that I have made considerable progress in bringing my meadow lands up to a higher standard. The past five years, excepting the last, were a serious drawback on their improvement. Open winters destroyed many fields of clover, dry summers put much of our timothy beyond the hope of resurrection. It is hard to fight against fate, but in this case it had to be done, and in the face of discouragements we were obliged to plow and re-seed with or without manure as best we could.

Each year, we see more plainly the necessity of better land culture. As in the south "Cotton is King," so here in the Champlain valley of Vermont, hay wears the royal crown. It is upon our hay crops that we chiefly rely for making the products from which we obtain our "needful."

Railroad communication has opened up a boundless West. Cheap transportation has placed us in earnest competition with rich new lands. Western butter and beef are sold at our very doors. Is there any hope for us? I think there is at least one, and that is to do our work better than our competitors, make our hillsides and valleys grow rank with grass and clover, our dairies, flocks and herds will increase, and not being starved out, there will be live Yankees whittling around here for many years to come.

LESSONS OF FARM LIFE.

By Mrs. A. D. Pottle of Stowe.

I count the past two weeks as among the bright, pleasant spots of my life, for they have been spent among the farmers of Washington county, and in their homes I have lived over some of the experiences and lessons of my childhood and early youth, which was spent on the farm. Rides among the snowdrifts have carried me back to the keen frosty mornings when a family of eight were seated on the ox sled, and the dear old oxen plowed through the snow, and landed us safely at the schoolhouse, where we were greeted with loud cheers and hearty hand-shakes. What cared we for cold or snow, the tingle of faces and fingers in the eager nipping air? And in looking back over the years, who is he that can not recognize the enjoyment that the warm blood of youth gets out of a genuine Vermont winter day?

From my window I could see the graceful skaters sweep like swallows over the solid pond. No polka or waltz was ever danced with the grace that inspired and characterized their movements. And the scene reminded me of the many reproofs which were gravely administered to us for wearing calf-skin and cow-hide soles on the ice, and although I consider the horse team and skates a great improvement, I could not restrain a sigh as I said to myself, they can not get more enjoyments than we had. Near the pond is a grove of majestic old maples; grand even in their winter life. They heed not the storm, but in silent waiting will ere long be clothed again. The sun sets just behind them, and throws their shadows upon the pure white snow, thus doubling the grove and reminding us of classic grounds. The sky is decked out as for a festival; and it seems as if the winter of 1884 was striving to rival the summer sunsets, kindling our souls into a flame, and making us feel how poor are all human efforts to paint like him who made the light arches of clouds black as night, piles light and fleecy as the drifted snow, or glowing like banners on a battle field, while here and there, through a long wind rift, the deep blue shows like God's great pity. Would it not be well for us all to break away for a few moments daily from the necessary avocation of life that so weigh down the soul, and learn to look for this art of seeing, as too little practiced if possessed? And those who have not cultivated this art cannot conceive the delight, peace and comfort which it brings to the soul pressed down with many cares, and perhaps a heavy mortgage. Some indeed there are who realize that cheerfulness is capital, and that it is the cheery person who succeeds best. It is as hard to keep such a person down as it would be to keep the sun from rising. Persons of true grit are no grumblers, cheerfulness

and courage, not whining, will win the day. Time spent in fretting might be better spent in admiring the clouds and the landscape. Sometimes a person's faculties, his health, strength, etc., are said to be his capital. The thing must have been created; but where the natural faculties have been cultivated to a degree over and above their first condition is of moment, as they are thereby capable of being made additional use of, their improvement evidently constitutes capital in one of its valuable forms; capital that is in ourselves and cannot be taken from us; more valuable than real estate or magnificent opportunities, and although many times the life of the farmer's wife seems naught to her but one of drudgery, yet let us see if she is not really the all important factor in the machinery of farm life. Many times in the past two weeks have I had occasion in noting the self denial and faithfulness of this class of women, to exclaim to myself, she is better than gold, yes, her weight in gold could not buy such services as she daily performs in her family. She, the real woman, is the patient loving mother, the substantial fact of the family. The toiling, watching, unwearied dispenser of comforts and blessings to her household and society. Not always uncomplaining, but never shrinking from the duties of her position. The real woman is the woman of resolute purpose, who boldly takes in her hand the fate of human lives, and stands by her self imposed duties with unflinching will. No faltering, no misgiving, no matter what the tide of events brings her, she breasts the storm and shelters by her own care and efforts those who depend upon her. Providing for the table while it is far from constituting the whole duty of the farmer's wife, certainly forms no unimportant factor in her responsibilities. It seems very wonderful that half the machinery of life should be set in motion, that mankind may be fed, yet this is quite true, and confers some dignity upon what needs all the dignity it can muster; for do not some of our girls regard housework as menial, even not respectable? Even poor people who have hard work to keep body and soul together, are effected by these same notions. There is something in the education of our youth, or something in the ideas which have been imbibed in the cause of their education, which seems to unfit them for their work, which makes them discontented, which disturbs them, and makes it well nigh impossible for them to accept the conditions of the lot into which they are born, and the employments which have been followed by their parents. It has indeed become a very serious matter, and deserves the profound attention of our educators and political economists. If by any study or any chance we could learn the causes of these great charges and obviate them, it would be a boon to the American people. As it is to-day, the enemies to what are called genteel employments are choked with the crowds pushing into them from our public schools. Young men with good muscles and broad backs are standing behind counters who ought to be engaged in more manly pursuits, who would have a better outlook before them, and would have a better life, and more self respect, if they were doing a man's work behind a plow or plane. There are women in large numbers striving for genteel employments, who would be a thousand times bet-

ter in body and mind if they were engaged in household work. There are men and women, even in these times, who hardly know where their next meal is coming from and have not the slightest idea how they are to procure their next new garment; they are still very difficult to please in the matter of work. We feel that this is all a mistake. Heaven forbid that we should seek to suppress any man's or woman's aspirations after excellence, or after improvement of personal position. But it is not possible that every lad who goes to a district school can become president of the United States, although most of them have been told more than once that the presidency is within their reach, and thus our youth drift away from the farm into some of the centers of trade and manufactures, to become a clerk in a store, or a teacher in some school, or a practicer of some art that relieves him from the drudgery of the farm, and has an air of greater respectability. And just here I will give an extract from Burdette:

HINTS TO YOUNG MEN.

"Remember, that the world is older than you are, by several years; that for thousands of years it has been so full of smarter and better young men than yourself that their feet stuck out of the dormer windows; and that when they died the old globe went whirling on, and not one man out of ten millions went to the funeral or even heard of their death.

"Be as smart as you can, of course; know as much as you can without blowing the packing out of your cylinder heads; shed the light of your wisdom abroad in the world, but don't dazzle people with it, and don't imagine a thing is so simple because you say it is. Don't you be too sorry for your father because he knows so much less than you do. Remember the reply of Dr. Wayland to the student of Brown University who said it was an easy enough thing to make proverbs such as Solomon wrote. 'Make a few,' tersely replied the old man. We never heard that the young man made any; not more than two or three, anyhow. The world has great need of young men, but no greater need than young men have of it. Your clothes fit you better than your father's fit him; they cost more money, and they are more stylish; your mustache is neater; the cut of your hair is better, and you are prettier, oh, far prettier than 'pa.' But, young man, the old gentleman gets the biggest salary; and his homely, scrambling signature on the business end of a check will draw more money in five minutes than you could get out of a ream of paper and copperplate signature in six months.

"Young men are useful and they are ornamental, and we all love them, and we could not engineer a picnic successfully without them. But they are no novelties—no, nothing of the kind. They have been here before. Do not be so modest as to shut yourself clear out; but don't be so fresh that you will have to leave the farm to keep from spoiling. Don't be afraid that your merits will not be discovered. People all over the world are hunting you, and if you are worth finding they will find you. A diamond is not so easily found as a quartz, but some people search for it all the more intently."

Evidently these false notions are a fault of the education. Teach them that the most favorable conditions are not always nor even generally the softest. A right notion of things is indispensable. Not that the world owes me a living; not that the highest aim should be to get through the world as easily as possible; and that the greatest pleasure is to do as others do, no matter if their income is ten times as great, but that it is manly and womanly to work, no matter how humble the occupation; that it is disgraceful to be dependent; that a plain dress paid for is better than fine clothes on credit. In the rush and struggle to have, are we not losing sight of the old-fashioned virtue which resides in being?

I believe it is the home education that makes the girls and boys despise the farm. One lady told us, "My girls are as good as anybody's girls"—a statement which we deny, because they are not able to make their own dresses or cook their own food. And the fact that her girls are as good as anybody's girls is regarded as a matter of pride, when they are helpless as babes, even though they have spent four years at a young ladies' seminary.

Yet we are glad to state that these are notions that this country is fast outgrowing. It is often said that the women of to-day are growing effeminate, and lack the sturdy heroism of their grandmothers; that they are vacillating and full of vanity. But this is not true. One must admire the stout-hearted pioneer woman of a hundred years ago, but there is no truth in the imputation of degeneracy; there is now and then one who shirks all duties and all responsibilities, and if we take human life in any earnestness at all, whether individually, as the passage to an eternal existence, the condition of which depends on what we are here, or collectively, as the highest thing we know, we can only look in blank astonishment at the idle woman and her career. She is the one sole, capable member of the human family without duties and without useful occupation; the one sole being who might be swept out of existence altogether, without deranging the nice arrangement of things, or upsetting the ordained balance. We know of no other organic creation of which this could be said, except the idle man, and he is the only worthless product of mature civilization. Dr. Arnold says: "there is no earthly thing more mean and despicable in my mind than a rich man destitute of all sense of his responsibilities and opportunities, and only reveling in the luxuries of our high civilization, and thinking himself a great person." Such a person would benefit society just as much, and we don't know but more, if he were killed and stuffed.

Dear sisters on the farm, work cheerfully on. Your homes are the pleasantest homes on earth. Your lives are the most useful, and as a rule the truest and best. You can train the eye to see all the bright places in your life, and so slip over the hard ones with surprising ease. I have often thought that if every person were to bring their misfortunes together in one place, most of them would be glad to take their own home again, rather than take a portion out of the common stock. Do not train the eye to rest on the gloomy spots in utter forgetfulness of all that is bright and beautiful.

If your sons and daughters cannot have the advantages of school and college that some have, remember that this is not the best part of a person's education, and that it is not always the person who has these advantages that proves to be of the most service to the world. Life on the farm keeps your sons from a thousand temptations. The necessity of earning all that he has, teaches him as only that process can, the value of the dollars, and then he has more ample means; he has with them the schooling that enables him to employ them wisely. There is a magnificent horizon of hope, in the country, especially for the young person who sets out in life with pure motives, and a high object, and a determination to do their level best. When we look at the temptation to take life easily, to excuse one's self from hardships, the temptations that beset the very best of sons and daughters brought up in luxurious homes, we dare not say that the so-called advantages of life for them are real. The poverty that braces a person up, and calls out all his energies, is it not an advantage? The necessity that gives one only the alternatives of work or want, the responsibility of having, perhaps, to support others of the family, causing one to disdain frivolties, and think earnestly and seriously of life and its work, are not these advantages? They keep a person to his place, and they provide for him a schooling he could obtain in no other way.

FARMING IN NEW MEXICO.

By H. M. Arms,—given at Springfield Meeting.

I feel that I owe an apology to my fellow townsmen for occupying time that would be much more profitably spent listening to others, and I shall hold our honorable secretary responsible for your loss, as it was his persuasive manner that brought me here to give you an outline of life on the plateaus. Dr. Cutting has given me a text, and if I wander far away from it and make my remarks very rambling, I'm sure it will not be a new experience to those of you who listen to the following of other texts. It is often easier to speak of what we learn in text books, or other guides, of a country of which little is known; but in this case it is a country without text books, or other guides, and one can only speak from the experience he or she may have had in the unknown land. In 1854 the coast line survey was begun and nearly completed under the most trying circumstances. The dry road, one hundred and twenty miles without water, was a serious drawback to the survey, and another and almost fatal obstacle was the Rio del Murito, or River of Death, which crossed the track of the party running a preliminary, and which but for the wonderful instinct of his horse, would have buried the young commander in a nameless grave. Crossing the plains, bare of grass, and coming to what looked like the bed of an old stream, with dirty sand marking its way across the country, the lieutenant's horse came to a sudden standstill, and after some urging ran back from the black line as if in fear, but the rider spurred the animal on at a run, and would have forced him in but for a shout from the guide, which caused him to look more carefully, and the black line was seen to be a moving mass scarcely below the level of the plains, and rightly named the "River of Death." The general and typographical surveys of New Mexico are not more than one-tenth completed at the present time, and as a consequence the country is unknown and unknowable. Agricultural farming does not pay, save in isolated cases, and there it is not profitable to the actual workers of the land. This is accounted for in different ways; but one or two reasons are sufficient. The ignorance of the farming community and the great scarcity of water are the principal drawbacks. Speaking of the scarcity of water reminds one of Col. Icholty, general land agent there, who in making spread-eagle statements to what he supposed a verdant eastern man; saying as a clincher, "This is the best country on earth to settle in; or would be if it had a supply of good water and refined society." The reply instantly returned was, "My dear, sir, that is all h—l lacks."

And from my own experience I can but believe with Gen. Sheridan who conducted the survey, and being asked how he liked the coun-

try and its people, replied "that if he owned New Mexico and the place of torment so graphically described in the Bible, he should sell New Mexico and live on the other plantation." Yet the soil is deep, black, and where wet is mellow, running often to a depth of twenty feet or more. With an abundant supply of water, cereals could be produced for years with no need of fertilization, and while I never saw English hay growing there I've no doubt it would grow if sown. The extent of the territory is really but little known, and I venture to say some who are here may not know its area. To say it is seven hundred miles long and four hundred wide, is not giving you even an insight to its size. We are used to large figures, and 250,000 square miles is not surprising, nor is it really giving us an idea of what such an area covers; but when I say New England is larger than France, and that England—England, which puts a price on every pound of bread we eat, on every yard of cloth we buy—England, which controls the prices of every staple product of our republic, as well as the product of the world—England, with all her millions of people, is but one-fifth the size of our southern territory, we get an idea of the possibilities of that country.

Twelve years ago, when I was locating there, I had the advantage of an old and till then honored law, that forbade the locating of any stock range, with a home, within three Spanish leagues, or nine Spanish miles, of any residence. That gave every man a right to a large range on the public domain, and made stock farming successful. Up to that time no white man had ventured to range stock of any kind in the territory to any great extent, and the wandering herds and flocks of the old Spanish families were a source of great profit, so that every owner lived in a town or owned a town, and had peons as really slaves as any of African descent. But a few years later the failure of a season's grass in Texas brought thousands of cattle away into New Mexico, and with them an element that was not an honor, nor yet an ornament, to the country. Up to the year 1874 to 1875, cattle were so cheap in Texas that every year thousands were killed for their hides alone, and it was a very easy matter for a small party of men to round up a herd of them, and putting on some brand that made them their own, (in their eyes) start across the terrible "Ilanno Estaeado," with its "River of Death," knowing that if they could elude the real owners of the stock and escape the Comanche Indians, and survive with their herd the 120 miles of drive without water, they would be richly rewarded when once settled among the abundant and nutritious grasses of New Mexico. That game is played out now, and has been for some eight years. The plains of Texas, New Mexico, Colorado, Wyoming and Montana, do not all of them furnish more than a needed supply of beef, and Mother England asks us to send still more to her markets every year. Chase, in his recently published volume of "Runs Through New Mexico," speaks of the sudden or at least generous growth of riches among some of the stock farmers of that territory. He mentions J. E. Temple and Senator Dorsey, and others, who were neighbors of mine, and whose suceess has been all that he claims for them; but, in order to answer the questions that are often asked regarding the profits of stock farming on the plateaus, let me

state what Chase omits, the sacrifices that are made of home comforts, to say nothing of luxuries. I will only mention one instance: Myself and my attorney were benighted at the house of one of those same rich stock men, and being asked in for the night, (for no one there sends a traveler away from their door) we found a family of eight or ten children, and we all ate and slept in the same room, with our saddles for pillows and our spurs for blankets. I might also add Senator Dorsey and wife and Col. and Mrs. Peck, of Star Route notoriety, were guests with us that same night, and that is only one instance in a hundred to show you why those people amass wealth. Let me say here, it does not require much skill to make a fortune; it does require a peculiar skill to keep it.

The grazing lands are high, averaging more than 5,000 feet above the sea level, and the better lands in the southern section are 7,000 feet. The air is pure. The sun shines 350 days every year, and the climate is all one could wish, for health, and generally for comfort, though the "Gentle Zephyrs" do sometimes lift miniature boulders through the window panes, and sometimes the snow and cold are a discomfort for a few days in winter. Agricultural farming does not pay. The country will produce nothing save by irrigation, and the water is often brought miles in ditches that depend on the melting of the eternal snows of the mountains for their supply. Corn, oats and flour are brought in from the states and furnish more food than what is grown in the country. The tools, plows, carts, etc., etc., are of the most primitive style, and if the farmer is offered good tools he declines with thanks. So lately as I was there I have seen contracts for hay to supply cattle at Fort Union that stipulated that the hay should be cut with a scythe and not with a hoe. You ask why will not the Mexicans use modern machinery? I often asked the question, and while many of the better class do use improved tools now, they used to say they could do better without them, and the results proved the fact. Formerly, when the country produced ten times the hay it does now with the increased amount of stock, contracts used to be made to supply the government with hay at $80 a ton. Now, with less territory to go over to obtain it, and with modern machinery for securing it, the price has fallen to $12, and even less. Hay and grain require the whole season to mature in, and wheat sown in February is cut in October. Oats and corn, sown and planted in April, are not harvested until a full six months later, and the hay is usually cut in October and November. The Taos valley is a fine wheat growing section, twenty-two miles long, three or four miles wide, and has usually abundant water for irrigation from the melting snow on the surrounding mountains. Twenty-two Mexican villages in the valley. Sante Fe, the Mexican's mountain, is 1,700 feet above the sea coast, in a basin twelve miles east of the Rio Grande, and the surrounding country is too poor to furnish grazing for mules. Merchandise and wood are brought to and carried from the town by pack animals. Burrows, so called, and the whole country for thirty-three miles up to the valley north, is so poor that nothing but the scrubbiest of scrub pines will flourish. The old Plazza Alcade, or "Town of Justice," where formerly every man with a grievance who did not settle his own

case was compelled to go to court, lies seventy-six miles north of Sante Fe, at or near the junction of the Charma and Rio Grande rivers, and there is a little section of bottom lands, formed by the San Juan Pueblo's, that is fertile and produces corn and oats for owner's use.

Stock farming among Mexicans is confined to sheep, or nearly so, and if one asks a Mexican how many sheep he has he always names the family flock, even if there be ten owners. For instance, Pedro Armijo told me he had 80,000 sheep, and I found the truth to be his family, consisting of father and five brothers and an uncle's family of about the same number, had about so many sheep. It was not a lie. Custom sanctions such language, and one gets used to it after a little and can make the needed allowances. I have told you that with water in abundance the soil of New Mexico would produce crops for years without fertilization. May I tell you of the straits to which a sister country is driven to obtain her supply? At the time the A. T. & S. Fe railroad reached Sante Fe, I was invited to witness the driving of the silver spike, and, as Gov. Lew Wallace said, to see "how the country could enthuse." After the ceremony, passing up to the grand plazza of the town, we had in our company a young English Lord, who was fresh from his native heath, and when his eye rested on the soldiers' monument, a fine shaft of thirty-five feet, which New Mexico has erected to perpetuate the memory of her dead heroes, he asked, wonderingly, why, what is this man? I assured him of its nature and use, and as he read the names of the several fields of blood and of the heroes who fell, he said, well, sentimental, ye know, but bosh all the same; and, taking from his pocket a copy of *Public Opinion*, an eccentric paper, he read: "The ship Mary Jane has arrived with three hundred tons of bones, gathered on the field of Pleona, where 30,000 soldiers bit the dust during the Turko-Russian war.' Comment is useless; but mark the comparison. Our country guards the dust of her defenders as part of our nation's life.

There is much of this kind of feeling there and must be where home is hardly lovable, and its location uncertain.

When I was there sheep herding was very profitable, and yet there were many drawbacks. The Indians liked mutton, and a little controversy of this kind gave me more knowledge of fighting than I before had thought of. When we were fired upon by the Indians, some six or eight of us all wanted to ride one horse, while the Indians of double our number covered a line of battle for three miles. We soon learned that we must scatter likewise. But I was going to tell you about sheep. Sheep breeding in New Mexico deteriorates the sheep. It is constantly necessary to replenish flocks from the north. I think there will be a market there for all Vermont sheep for one hundred years to come. They must have them. The alkaline dust injures the fleece, also the quality of the wool. Many sheep are kept there. New Mexico stands as the fourth of our States in number of sheep, and eighth in production of wool.

DAIRY FARMING.

An Address before Lunenburgh Institute, by Frank C. Grant, of Concord, Vt.

He said he believed in common sense facts, not in theories, though they might be well enough in their place, but not in farming. Be that as it may, we all love good butter, and the remarks we make will be: First, about a good dairy farm; second, about what constitutes a good dairy.

In relation to the first part we do not want wet pastures, or at least swale pastures, hence the pastures should be dry land. We would then have a variety of grasses; not of sedges or poor kinds, but our best clovers, herdsgrass, red top and other sweet and nutritious kinds. The meadows should also produce the same varieties that the hay be desirable. With such a farm it would be natural I should speak of Jerseys, and I shall, yet if I raised beef I should prefer Shorthorns or Devons, and some of them are good milkers, but when you come to the butter the butter will get soft, and in hot weather even sloppy. The Jersey butter will never get thus soft. My experience is in favor of Jerseys, because it is the butter that brings the highest price. The butter that gets the premiums, and the desirable butter, is all made from Jerseys. If you make inquiries in market you find everywhere the same story. It is the best. I do not think there is any special difference between the Guernseys, Jerseys and Alderneys, as they are all bred for the purpose of butter. The western creamery butter, while it leads in price, is not the best in market. The reason is the capital controlled by the board of trade owns the western creameries, but Vermont creamery butter is really in the lead, and will be found so by the investigator. In relation to caring for dairy stock we need in the first place kindness, even politeness, as much so as you need anywhere. Cows must be contented, and not kicked or afraid. If they are found so I always know the owner is no gentleman. He then related an incident where two boys milked alternate weeks. One was kind, the other not, and the kind milker obtained a pound of butter more a week than the ugly one, though they both milked clean.

In selecting cows we want the cow that gives a good mess of milk and yet one that makes good butter. Some cows make enough butter, but the butter is neither firm or good flavor. Such cows as I used to think best, I find my poorest and reject them.

Among the grasses I find red clover, cut just as it blooms, the best hay to feed for butter purposes, yet I believe that the best butter cannot be made from hay alone. I would feed some other food. Corn meal I consider the best for butter, but too concentrated for the good of the cow. For the care of the milk I will say I believe it should be so cared for that we can get the best prices. I am very particular

about milking that no dirt or odor injures the milk. In my milk room I have nothing but my milk and the vessels that contain it. I in no way allow the smell of doughnuts, cookies or pies to get into my milk room. I believe milk should always be strained through a good cloth strainer, and often of more than one thickness. I watch the temperature of my milk room and of the rising cream so that I may skim at the exact time, learned by experience; and no postponement will do; I believe on this proper time of skimming depends much of the success of the best butter makers. I use open setting, the Jewett pan. I do not know them to be the best, but I get very good results. When I let my milk room cool down to forty or forty-five degrees, I always have poor butter; when it gets up to seventy degrees it is always poor also. I churn at sixty degrees in summer and sixty-two in winter. I use the barrel churn. If the cream is fifty-seven degrees I raise the temperature by adding one-third water at about sixty-four degrees, which brings the cream nearly right. If the cream is above I put in water a little cooler. This is my way. I wash in the churn when it is granular, and before it lumps the size of my fist or larger. I believe the temperature should never go below fifty degrees, and never above sixty-five degrees. If it does my butter is always injured by it. I believe the injury greater when it runs lower than fifty degrees, than it is to run higher than sixty-five degrees, but it is a damage anyway. I never let ice come in contact with cream or butter. I never wash butter in water below fifty-five degrees or above sixty-three degrees; would have it fifty-eight degrees. I wash it, but some others do not, with good results.

I color my butter in winter, and always work over in not less than six hours from salting. I never touch with hands. I use one and one-half ounce to the pound, salting always by weight. I think one-half ounce remains. I have sold my butter for forty cents net this season. My cows make the most butter per quart when they give the least milk.

EXPERIMENTAL FARM EDUCATION.

A Lecture read at the Windsor meeting of the State Board of Agriculture by Rev. J. H. Winslow.

The time was when the farmer was not supposed to require an education. Brains or the use of them was a commodity in which he was not supposed to deal. If the boy exhibited a thirst for knowledge it was evidence he was never cut out for a farmer. That boy would be a clergyman, a doctor, a lawyer, a merchant, or at least a merchant's clerk. The boys in frocks would need only education sufficient to enable them to compute interest. Now all is changed. And among our farmers we find our most educated men. To-day an educated farmer is a more comprehensive term than when applied to almost any other individual. Now if he be an experimentalist, he becomes a chemist, a geologist, and a botanist, and whether he has made these sciences a study or not, through a course of observations he has become acquainted with the plants he raises and the food they require. There is many a farmer that, should he be asked if he knew anything of these sciences, would answer, no. Yet this same man would know upon what soil to plant corn, potatoes, beans, etc., and would know how to prepare the soil for the best results. He might, suppose he knew nothing of zoology, yet he could select you a good cow and tell you what she will demand, for the best results. To-day the science of agriculture embraces nearly every science.

The Rev. Dr. Allen, president of the Maine state agricultural college, truthfully asserts that agricultural science levies its contributions on all the vast resources of human learning, and takes tribute from departments of study apparently most remote. While it would be impossible for the man engaged in practical farming to become thoroughly acquainted with all the sciences, yet he may, and if he desires success, should avail himself of the result of the labors of the men of science. Then by a series of practical experiments, the result of their investigations, it will become a part of his own education. While this course is being pursued by our best farmers and the traveler's eye rests now and then upon a farm which gives him pleasure, yet he can but observe that there is much farming done in a haphazard and slovenly manner, affording neither satisfaction nor recompense to the farmer. If they would study their soil and seed, their flocks and herds, if, instead of trying to make deposits in the savings banks, they would make their deposits upon their farms, in the way of improvements, might we not expect our sons would remain in our old Green Mountain State instead of wandering from us? If money be our shrine, if at this altar we bow, brother farmer, your farms can be made to pay a larger dividend upon the deposits than any savings bank within your reach. If our young farmers of average ability will keep their eyes open to the experiments of others, and yearly, by

actual test, come in possession of facts that cannot be disputed because proven, they can but become masters of their situation and possess themselves, an ideal farm. The great defect in our farming is, we guess too much and know too little. An English farmer was once asked, How much wheat can you raise per acre? His answer was, We can readily raise thirty-two bushels per acre, but twenty-eight bushels is a more profitable crop, the extra four bushels costing more than its value. How few Vermont farmers could give as intelligent an answer as that. It is true experience is the best schoolmaster, but it is not necessary to-day to pay him high wages; with but a trifling experience every farmer may come in possession of facts that will not only prove rounds in the ladder of his education, but rounds in the ladder of his wealth. We often speak of good farms and poor farms, would it not be more proper to say good farming and poor farming? I remember when a boy, farmers for miles around came to my father's to buy seed wheat, not but that they had wheat, but they had everything else with it. They wondered how a man could raise wheat and not have it mixed with oats, kale and cockle, buckwheat, etc. I knew, for it was a part of my work to pull out those tares. Father, though a christian, did not believe in letting tares and wheat grow together until harvest. Those who knew how he raised wheat that was clean said that it did not pay, but when they came to buy seed wheat they grumbled at the price, but father used to say, I do not eat York flour for nothing. We raised more bushels of potatoes to the acre and of more uniform size than most of our neighbors, they cutting their seed coarser than we, planting two or three pieces in a hill, while we only used one piece in a hill, and the hills were nearer together, making the rows looking like one continuous hill.

Ten and eleven years ago my home was in the Connecticut valley; near me were two meadow farms, divided simply by a fence. The one yielded three tons of hay per acre; the other, three hundred pounds. Farmer number two complained of drouth; farmer number one rejoiced in an abundant harvest; farmer number one is the third generation of the same family, living on the same farm; farmer number two loses his boys from home as soon as seventeen or eighteen years of age; farmer number one took care of his farm and his farm took care of him; farmer number two watched at the depot nights for his support. The past season near my home in Lunenburgh a board fence divided two fields, owned by two men. The fence could have been dispensed with. From one field, Dr. Cutting's, there was harvested three and three-fourths tons of hay per acre, from the other not more three-fourths ton per acre. One man fed his field, the other man fed himself. The past season I bought one and one-half acres of grass for thirty dollars. Those who had never weighed an acre of stout grass laughed at the minister's trade, but when it was harvested I had four tons, one hundred and ninety-six pounds of well cured hay. Two years ago Dr. Cutting bought a field of four acres. The hay was all drawn from this field at two loads, one one-horse load and one two-horse load. The next winter one acre of this field was treated to a coat of manure spread on the snow. In the spring the rest of the field save one-half acre was also top dressed, the manure

spread upon the grass at the rate of five loads and two hundred pounds of land plaster to the acre. Last season the hay was drawn from the field at eight two-horse loads and two one-horse loads. The part where the manure was spread on the snow yielded about one-half more than where the manure was spread on the grass. Similar experiences, and others I have not time to mention, are observed by every one who is on the watch for them. Should we test them and know from our own experience that they were true, might we not easily increase our hay crop? Many farmers seem entirely indifferent as to the quality of the seed they use, and as a result the farmer who is penny wise in the spring finds himself pound foolish at harvest. I remember a neighbor once complaining that his potatoes were all small; they would not grow large. Father, seeing him planting one day, told him it was no wonder, for he had planted small potatoes year after year. He was advised to buy seed suitable to plant, but being a penny wise man he thought he could not afford the outlay, but finally concluded to invest two shillings and buy a whole bushel. They yielded double per rod compared with the rest of his field, yet this man thought he could not afford to buy potatoes to plant. When some farmer has introduced a new variety of potatoes which yields abundantly, many farmers say, "they will be plenty in a few years, and then I can exchange a bushel and get into the seed in that way." I cannot afford two or three dollars per bushel for potatoes to plant, when money invested then would have yielded one, two, three, four or five hundred per cent. This was once illustrated in the town where I now reside. Hon. Jonah Brooks originated a potatoe known as the Brooks' seedling. This was started from the ball of the so-called Hastings potatoe. This variety the judge selected from others, and continued planting it until in 1868 he planted a little over one-half acre from which he harvested between four and five hundred bushels. Mr. Brooks then offered them for sale at four dollars per bushel. Many could not afford to buy, but others invested, and in harvest regretted they bought so sparingly. John Smith of Acworth, N. H., raised seventy-five bushels from one-half bushel seed. Hon. Milton Cook of Bloomfield raised thirty-five bushels from fifteen pounds of seed. J. M. Dodge of Lunenburgh, six hundred and forty bushels from one acre. The second year that the Early Rose potatoe was planted in Essex county, F. C. Grant of Concord raised four hundred and eighty bushels of that variety from an acre. Last fall when Esq. Grant's neighbors were wondering why their Early Rose did not yield as in former years, he (Grant) was harvesting three hundred bushels per acre of the Early Vermont. Last season was a very unfavorable one with us for potatoes, yet those who planted the Early Vermont where the ground was properly prepared did not come much short of three hundred bushels per acre.

I will call your attention to but one more mistake that impoverishes our Vermont farmers and makes farming with them a drudge. I speak now of the indifference of many farmers as to the quality of their stock. With them a horse is a horse, an ox is an ox, a cow is cow, a calf is a calf, a hen is a hen, and they fail to see any difference in the value of two animals of the same kind. I have heard farmers

say they did not care what male they used with their herd, one was as good as another; all they cared for was the right number of calves at the right time. One farmer told me within the past year (and he is a man who milks from twenty to thirty cows) that he would not give any more for a heifer calf from one cow than from another. How few men know the relative value of the cows they keep. I once bought two cows of the same man. Both cows had been owned by him for two or three years. One cow I thought I wanted, the other I thought I did not want; but in order to secure the cow I wanted I was obliged to buy both. When I came to test the cows, I found the one I thought I did not want was just the cow I did want, while the one I wanted was worthless as a dairy cow. Many cows run their owners in debt every year, but they know it not. With proper breeding and proper feeding, with proper care in manufacturing the butter, the cows of Vermont could in a few years be made to yield one hundred per cent. more than at the present day. I know of men who were called good dairymen ten years ago, but they were dissatisfied, and by paying better attention to breeding and manufacturing they have increased the income of their dairy fifty to one hundred per cent.

A few years ago I visited the dairy of Judge Parks of Passumpsic, one of the finest herds of cows I ever saw; there was not a cow seemingly in that herd whose business was simply to count one. I saw in one of our country papers lately an item touching this dairy that may be of interest to us. And let us remember, brother farmer, that Judge Park's cows will not do any better than your cows or mine, provided we have as good blood and care for them as well. But the judge reports a full better statement this year than usual. He kept twenty-five cows, four two-years olds, three three-years olds and the rest older. Five of the oldest cows were sold in October, and the judge thinks the twenty-five cows in his dairy about equal to twenty-two cows in their prime. From June to November each cow consumed less than two dollars worth of meal. The products of the dairy from January to January were as follows: sold 7,110 pounds of butter for $2,434.23, used 250 in the family, made 150 pounds of cheese, equal to 75 pounds of butter, used milk and cream equal to 100 pounds of butter, sold $25 worth of milk, equal to 73 pounds of butter. Total products of dairy 7,608 pounds, butter worth $2,604.79. Sour milk fed to hogs worth $250, calves sold and raised, $200; making the entire product of the dairy $3,054.79. It will be seen that very little of this statement is estimate, $2,434.23 being cash received for butter. In the remaining items the judge thinks he has made the figures low. Who says Vermont dairying properly conducted will not pay? The judge's cows are Jerseys, four full blooded and the others three-quarters and seven eighths. He is now making 100 pounds of butter a week, and in June made 200 pounds a week.

In all departments of agriculture success and failure are separated only by a line fence. And, brother farmer, as true as God has set eternal life and death before us, and permitted us to choose which we will, so before the Vermont farmer has he set success and failure, and here we are permitted also to take our choice. Remember it is written, "Whatsoever a man soweth that shall he also reap."

AGRICULTURAL CHEMISTRY.

A paper read before a meeting of the State Board of Agriculture, by H. G. Day, of Bradford.

I have called the caption of this paper *Agricultural Chemistry*, yet none of you but may at some time have taken up a concert bill, and have read on the programme the announcements—"violin *solo* with *variations*"—and it often happens that the "variations" are the essential part of the performance; and if I should digress from my subject I trust you will pardon me, even though the digression should prove the essential part of this paper.

In a former paper we attempted to treat in a familiar and elementary way of the various organic and inorganic elements which contribute to the support and nourishment of plant life. As the soil is the grand laboratory in which civilized man works out the problems of life and sustenance, let us first briefly consider soils. The main constituents of all arable lands are clay, loam and sand—mixed in varying proportions, and while all these elements are necessary to a fertile soil—it is a well known fact that lands which are all clay or all sand are absolutely barren—neither one containing enough of the elements of plant life to support vegetation. A sandy soil is probably regarded by most farmers as the most absolutely worthless of any, and yet this very sand, chemically known as silica or silicic acid, is a very important element in agricultural economy—but is one of those things of which enough is as good as a feast—and better.

Sand or silicic acid at ordinary temperature is the weakest known acid—but put it in the crucible and raise its temperature to the melting point and it becomes one of the most powerful. Potash has the power of dissolving it and making it available for the sustenance of plants—and as all of the cultivated grasses and some of the grains are silicous plants, *i. e.*, requiring a larger amount of silica—potash is a valuable fertilizer for such crops. The form in which it is assimilated by the plant is that of a soluble silicate, and this, I believe, is the only form in which plants can take up silica, and the rule is that potash can only be assimilated in the same form.

The office of the silicates is to form the skeleton of the plant—and to give them the strength which prevents lodging and without which they will not be able to withstand the fury of the gale or the breath of the zephyr. A plant which did not contain the silicates would be like an animal without bones—practically useless. Caustic soda has the same power of forming silicates with sand or potash, and in a less degree common salt probably has the same power. The well known fact that sandy soils will not retain a sufficient amount of water to nourish vegetation has led to a great deal of discussion as to whether such lands leach or not. So far as practical results are concerned it does not matter whether your fertilizers are carried down by the rain

so far as not to be available for the support of your crops, or whether they evaporate or go off in the air, they are gone in either event, and the power of such lands to retain fertilizing material is just as limited as its power to retain water, which is the grand solvent, the universal and only vehicle by which all fertilizing material is made available for the process of plant life. A soil that is not reasonably retentive of water cannot retain fertilizing material well—hence it would be poor economy to put the same amount of fertilizer upon such soils that might be profitably applied to more retentive soils—the rule with such must be, light and often—the oftener the better. The properties of clay are too well known to require mention; but there is another substance that enters into the composition of arable lands—the importance of which cannot be too highly estimated in determining the value of soils, and that is the rich vegetable mold, formed of decaying organic matter, and technically called *humus.*

By the general term humus, we must understand a mass of brown, decaying matter, partly soluble, partly insoluble, partly acid and partly neutral, which with the uninterrupted presence of air, heat and water may be still further decomposed, and thereby carbonic acid and water are indispensable to the nourishment of plants—hence in a soil rich in humus the plants will grow more vigorously, because they find there and absorb by their rootlets more of these nutritive substances than they could in a soil poor in humus. Moreover, this substance exerts a beneficial effect upon vegetation, because it loosens the soil by the development of carbonic acid, because it possesses the power of attracting water from the air and of retaining it for a long time—and because of the acids contained in it, it is able to abstract from the air and also from manure that very essential element in the nourishment of plants, ammonia. The good farmer knows by experience that the humus diminishes in his fields, and the more rapidly as the crops are more abundant. He knows the fields rich in humus are more productive than those that are not—therefore, he seeks to restore the humus either by manuring or by fallowing. The value of clover as a fallow plant depends upon the large amount of roots which it leaves in the soil which by their decay tend to the restoration of the humus. When your fathers first settled on the lands you till, they found a soil rich in humus, and which the custom, then prevailing, of burning the timber on the land on which it grew, gave a rich dressing of the soluble alkaline salts, and they were, for many years, able to raise without much trouble, such crops as you with your more careful and improved methods of cultivation may hope to equal, but may not hope to excel; but with you the case is different—this dressing of soluble salts has long since gone, and the humus is rapidly disappearing, and your lives if you would succeed as farmers must be a constant struggle to replace by artificial means the elements your fathers found in abundance. How must you do it? The inorganic elements, viz: potash, lime, soda, phosphorus, etc., are considered by some authors the principal ones—and a due proportion of them is absolutely necessary to the development of the perfect plant, yet the man who relies wholly on these, might be likened to the man who should attempt to raise an

animal all bones. I know that some farmers unwittingly meet with tolerable success in the latter attempt, and quite likely wonder how it all happens, but I have never heard such men classed as successful farmers. And while the inorganic elements must be supplied to the soil, you must on no account neglect the organic branch of the question. In many fields the organic matter is already gone—it is diminishing in all, and the inexorable law of self preservation demands that in fertilizing your fields you should pay attention to this matter, and should supply as far as you may the loss of organic matter in the soil.

The true theory of fertilization consists in applying to the soil a due proportion of all the elements necessary for the nourishment of plant life. Any other theory is faulty and imperfect. You can buy the inorganic and ammonical elements of fertilization if you have money enough ; but the organic elements, to form the humus, without which your farms must lose their fertility, must be looked for on the farm only. The weakness of the whole system of commercial fertilization is this : that while it proposes to restore to the soil the salts, phosphoric acid and ammonia taken from it by cropping it, makes no provision for the restoration of the humus, without which all your efforts must fail. Every farmer knows that if an animal were fed only on rich concentrated food, that animal would not thrive—there must be something fed for bulk. So with your lands, there must be something for bulk, else the best of them will wear out. I would not condemn altogether the use of concentrated manures ; they may, and probably do, have their place in agricultural economy, but that place is, and in the nature of things must be entirely a supplementary and subordinate one. They may be, and doubtless are, useful for purposes of special fertilization, but for general purposes your reliance must be in such fertilizers as can be secured on the farm, that is stable manure carefully and freely applied. In the use of such you can make no mistakes, as it contains within itself more of the elements of plant food than any other substance used as a fertilizer, provided you apply it freely enough. But in the use of concentrated and commercial fertilizers it is quite possible to get the right thing in the wrong place, and if one would use these things with economy, he must know the exact needs of his land so as to buy just what he needs and nothing else. If he needs potash, let him buy potash ; if phosphoric acid, let him buy phosphoric acid. But you may ask how shall I know the exact requirements of my land? The limits of a paper like this necessarily preclude an exhaustive answer to such a question—it would require a volume for that—but doctors diagnose the diseases of their patients by the symptoms, and with a little careful study and practice I see no good reason why you should not determine the wants of your land by the symptoms, and make as few mistakes as the doctors do. You are urged to try experiments with "plots" of land and note the effect of various methods of treatment. That is all right, and it is only necessary for me to urge you to be exact and careful so that the results may be something better than mere guess work ; but if you will first study the requirements of the various plants, and especially

the grasses, and learn the effect of the different elements of plant food on the growing plant, you will be saved from many discouraging failures and will more easily attain that exact knowledge which is the object of your endeavors.

And now before we leave this part of the subject I want to ask the man who buys commercial fertilizers, if he is very sure he is saving all the manure about his own premises that he might save. If not, the money so spent represents only a big leak in his management, and I ask him to spend as much in the future in making manures as he has spent in the past in buying them, and I believe he will get a much more satisfactory return this way than in any other. A single dealer in this country sold the past season over eighty tons of one brand of commercial fertilizer, which at forty-five dollars a ton would amount to the sum of thirty-four hundred dollars, and this would indicate that the total sales of such in the country must have been at least twenty thousand dollars. I ask you to consider for yourselves how much of this large expenditure represents simply the big leak and how much of it was used with a real knowledge of the wants of the crop to which it was applied.

I wish now to call your attention to the composition of some of the commercial fertilizers. Take the last report of the Vermont Board of Agriculture, and turn to the analysis of Prof. Sabin of the different ones found in the Vermont market, and you will find they all consist of phosphoric acid, nitrogen and potash in varying proportions, with organic or inert matter enough to bring up the bulk to the commercial standard. Now bear in mind the fact that bones contain nearly one-fourth their weight of phosphoric acid, besides gelatine and other carbonic acid and ammonia forming substances; that the excrement of fowls is rich in nitrogen, and that the fertilizing property of ashes is potash, and you will inevitably come to the conclusion that with a few hundred pounds of old bones and a little sulphuric acid to reduce them—a little hen manure and some ashes—you can at a comparatively trifling outlay make a commercial fertilizer equal to the best in market.

It is not many days since one of the best farmers in a neighboring town told me that he had prepared it for his own use with perfectly satisfactory results, that he should continue to do so and could do it at a very considerable saving of expense; and I am glad to note that there seems to be an increasing disposition on the part of the farmers of this section to inquire into these matters and see if the necessary fertilizers may not be prepared at home and the heavy outlay for them saved—and I am happy to assure you that with a little time spent in careful experiment in this direction you will meet with perfect success. I wish to allude to another idea that has been prevalent among farmers, and that is the notion that the value of a fertilizer was in proportion to the vileness of its smell—nothing could be further from the truth—it is not necessary that any fertilizer should emit stenches as many and as vile as ever had the city of Cologne; and the principal effect of such villainous smells is only to make your boys disgusted with farm life and farm work. A perfectly prepared fertilizer

will be comparatively inodorless—and the various gases which cause these horrible stenches will be fixed and absorbed by the use of the proper agents. It is not many years since we have heard of farmers who mixed hen manure, plaster and ashes, and judged from the smell that the compound must be a powerful fertilizer. Such practice is in utter violation of the principles of chemistry, and the smell on which such practitioners dote is from the ammonia set free by the action of the lime of the plaster, and represents only so much dead waste of the fertilizing material.

You have probably often read the phrase, "rich, nitrogenous plant food," and to the minds of some it has, perhaps, carried as much meaning as would an essay in the original Greek—and no more—and perhaps I may not make its meaning clear to you. In all the varied works of nature, chemistry has been able to discover but sixty-three different elements, and of these the farmer has to deal with hardly a dozen, of which nitrogen is one and hydrogen another. Necessary as nitrogen is to the farmer, it can only be taken into the structure of growing vegetation through the agency of a third element, and that is hydrogen, with which it unites in the proportion of one to three, losing one-half its bulk by the union and forming ammonia. Ammonia is capable of still further concentration—thus water will absorb six hundred times its bulk of it; by contact with sulphuric or carbonic acid it crystalizes into the soluble salts, sulphate or carbonate of ammonia, well known as fertilizers, and a free definition of the phrase, "rich, nitrogenous plant food," would be one which furnishes a large supply of ammonia to growing vegetation, on the growth of which it acts as a quickening spirit, and in whose structure it is again resolved into its original elements. There is another question which does not come strictly within the pale of chemistry, yet is so nearly allied to it and is of such vital importance to the farmer that I may be pardoned for alluding to it,—water—lacking a due supply of water all your efforts will fail, however well directed. It is the universal and only vehicle by which all the fertilizing materials, of whatever nature, which you apply to your soil, are made available for the processes of plant life; only through its agency can plants draw nourishment from the soil. How necessary then that the supply of water in the soil be steady and unfailing. Yet year by year this supply is growing more and more uncertain, at certain seasons your rivers shrink to brooks, the brooks to rills and the rills dry up altogether. Why? It is but little more than a century since Vermont was covered with the primeval forest, the moisture was more equally diffused and the little brooks instead of being raging torrents for a time and dry gullies for the rest of the season, flowed on continuously toward the sea. Only a little more than a century and yet the age of the pioneer and the lumberman denuding the soil of its forest has caused this change, and still the work goes on more rapidly than ever before, yet no practical measure has been devised as a remedy. I ask you to consider what the conditions of the State will be if this work is to go on for another century, unless some effectual means are adopted for the preservation and perpetuation of our forests. Will it not, indeed, be the very

picture of desolation, a waste of barren rocks and shifting sands? The preservation of the forests means fewer drouths, fewer floods and a more uniform rainfall. Then cherish the forests as the very apple of the eye, as the great conservative power which will preserve for you, intact, uniform and undiminished, a due supply of this great life-giving element—water. The tenure of lands in this country is such that private enterprise cannot be relied upon to accomplish this work, and you must look to legislative action for the remedy. I see that the governor has, by authority, appointed a commission on forestry to inquire into this matter, and your part of the work is to sustain and encourage them, and to see and insist that suitable recommendations have that attention at the hands of your legislators which the importance of the subject deserves. Statesmanship seeks to preserve and develop the resources of a country, *demagoguery* takes up a popular cry and seeks to out Herod, even Herod himself, in its zeal for the topic of the hour. Can there be a truer statesmanship than that which seeks to restore the forests to the hills and retain for this grand old State the character of a land of fertile fields and pleasant homes. Your legislature can go wild over the taxable age of a pup, can get enthusiastic over a measure of doubtful constitutionality and still more dubious justice, like the Hooker law of the past session,—has even the "cheek" to ask intelligent and able men, capable of giving us instruction and good advice in regard to our wants and needs, like those who have come to meet us to-day, to work for the pay of a common laborer—why then not wage it for once to rise to the dignity of statemanship, and give a careful consideration to this question, which is of such importance that all the dog laws, hen laws, and other legislation of the kind that ever was or ever will be enacted, sink into insignificance beside it.

One more digression and I will close. The latest fashionable hobby in farming is ensilage and the silo. Some of its most enthusiastic friends make great claims for this plan; even going so far as to recommend storing all forage crops in this way. The inhabitant of the tropics may feed on bananas and rice, but the Esquimau feasts on blubber and irrigates his internal economy with train oil; this is in accordance with the well known law of natural adaptation, and teaches us that the food of men and animals as well, must be adapted to the conditions and climate in which they live—and the lesson we should draw from this fact is that the food is perfectly adapted to the wants of our stock in the summer does not contain enough of the carbonaceous and heat producing elements to make it adapted to the wants of the same animals during the severity of our almost Arctic winters—and that if you would feed ensilage, you must feed with it a sufficient amount of rich, concentrated carbonaceous food to make up for the deficiency of such elements in the ensilage. It is claimed by some that there is very much more nutritious matter in an "ensilaged" plant than in one cured in the ordinary way. A very large percentage of the weight of green plants consists of water, and while there may be some loss of nutritious matter in drying, it is difficult to see how that percentage of loss can be a large one in properly cured fodder. I apprehend

that the silo will have its place on the model farm of the future—but I believe its place will be an auxiliary and subordinate one, limited to supplying your stock with an agreeable change of diet—keeping their digestive powers in good condition, and thus contributing to the satisfaction and profit of the farmer. And now, gentlemen, to sum up the whole question in brief, the elements necessary to plant life are the organic ones, carbonic acid, water and ammonia; and the inorganic ones, potash, lime, soda, phosphoric acid, etc. Given these in due proportion; given a soil rich in humus so that the little rootlets of your plants can penetrate it and draw from it their necessary food; and with God's own sunshine, light and air, there is no excuse for failure.

CHEMICAL FERTILIZERS.

Read at the farmers' meeting held by the Board of Agriculture at Wells, January 3, 1883, by Dr. A. C. Grover.

Mr. Secretary and Gentlemen of the Board of Agriculture and Fellow Citizens:

I am well assured that I can add no new or important facts to the knowledge of those present, but the subject of improving the productive resources of the soil is one of primary importance, that all may feel an interest in the discussion of its nature, methods and results. What I have here written is a small amount of information which I have from time to time picked up in a superficial or general way. I have not by any experimental deductions of my own arrived at any new lessons on the subject, by which I can instruct any one, and in this brief paper our object is simply to aid in keeping up an interest in the subject of a practical nature, of first importance to agriculture, and which promises to become of greater importance as time goes on.

We find in our newspapers, in social intercourse and in the discussion of farmers' clubs, that the conviction is general, that there is a constant loss in the productiveness of the soil going on under the present general management. It is claimed, and justly so, as we all well know, that the thousands of tons of the various products of the soil annually shipped to the old world, are depleting our farms of a share of their richest ingredients which, unless we learn how to supply them, will in the course of time cause our farms to become of but very little value, compared with their present none too good condition.

It is stated by chemists that there are fourteen chemical or inorganic substances found in plants. Of these we are informed that on nearly all soils all but three are found in ample quantity, the three stated to be usually deficient are nitrogen, phosphoric acid and potash.

Twenty-five bushels of wheat harvested from an acre contains, we are told by chemists, forty pounds of ammonia or its equivalent in some other form of nitrogen. Where is the soil to obtain a supply sufficient for such a crop when it is once exhausted of that element.*

Careful experiments in Europe prove that the rain fall brings from the atmosphere the equivalent of ten pounds of ammonia. The straw, if all returned, about ten pounds more, leaving twenty pounds to be supplied from some other source. If taken from the stable we are only taking away from one part of the farm to supply another part.

Nitrogen is not only supplied by ammonia but by the nitrates of soda and potassa. Though plants contain but a very small per cent.

*Much nitrogen is in some mysterious way taken from the atmosphere.

of nitrogen, that little is absolutely indispensable to their growth. The practical deduction from the foregoing fact is that the nitrate salts or ammonia must be found in sufficient quantity, and in a condition to be dissolved by rain water, or it must be supplied by artificial means.

Another element of plant food, no less important than nitrogen and more difficult to obtain, is phosphoric acid. The amount of it necessary for plant food is very small but none the less essential, for without it the crop fails. A crop of twenty-five bushels of wheat harvested from an acre, takes fifteen pounds of phosphoric acid from the soil in the grain, and eleven pounds in the straw, when repeated cropping reduces this element in a marked degree, we shall get a good early growth of straw but very little grain. But very few soils have a large supply af phosphoric acid. The blue grass region of Kentucky has this element of fertility in a large amount, but any soil once deprived wholly of this acid becomes unprofitable, and ever after will have to be replenished by artificial means. The most direct supply of phosphoric acid is found in bones; to be made available they must be reduced to fine powder, and to get their readiest effect the bone meal may be made to dissolve in rain water by being mixed with sulphuric acid. Another source from which to obtain phosphoric acid is the phosphate rock, containing large amounts of the bones and excrement of marine animals, found in South Carolina. Guano also contains it largely.

The other remaining article generally lacking and most difficult to maintain is potash. The source of supply of potash is found in unleached wood ashes, and in beds of chloric potash found a few years ago in Russia. The straw of wheat has twice as much potash as the grain, and the cornstalk has four times as much as the grain, and we can readily see the usefulness of restoring those parts to the soil.

Some fertilizers act indirectly, as lime and plaster, which hasten decomposition of organic material, or forms new and more soluble combinations with chemical elements already in the soil. We frequently hear the expression that chemical fertilizers are a stimulant of vegetable life, but my understanding is that a direct fertilizer is a nutrient, a food for plants, as certainly as bread is food for the human system.

Now there may be some present who have not a clear idea of how the substances spoken of above can exist in plants. We will suggest for your reflection that if you were to evaporate a few quarts of common lye to dryness, you will find a few particles remaining in the bottom of the vessel having a strong brackish or salty taste. So if you were to burn a hill of potatoes or corn, or a bundle of oats, the roots, stalks and grain together, and carefully leach the ashes and evaporate the lye, the same result of a residue of particles, very small in amount, will be found in the bottom of the vessel, having a marked saltish taste; these particles are a share of the potash and other elements which the chemical fertilizers are called upon to supply as plant food.

The agricultural interests or prosperity of this country depends largely on the free use of the various resources of plant fertility; whatever diminishes the confidence of farmers in the utility of any

valuable fertilizing substances, tends to diminish production and thus far becomes a public evil. Farmers, I fear, do not always think that in the production of a crop nothing is created; that there has only been a change of combination in certain material formerly existing in the land and air, into plant structure, a transformation merely, by the vital power of the plant, of certain salts and gases which were taken from the air and soil by the leaves and roots. The general interest manifested in the subject of fertilization is the most hopeful indication of prosperity in farm cultivation, in both the near and remote future.

The meetings held by our State Board of Agriculture, I learn, are usually well patronized. The newspapers devoted to agriculture are active in discussing this vital interest, and in furnishing suggestions as to its methods and profits. I learn from an article published in the columns of the New York *Tribune* from the pen of George Geddes that the farmers of western New York are compelled to abandon to some extent the raising of clover, to plow in to enrich their farms, and are largely resorting to phosphates, their land becoming exhausted of the elements of clover fertility and the crop fails as a resource for replenishing their acres. For years chemical plant food has been used on the poor cotton lands of our countrymen in the south.

My attention was first directed to the subject of chemical plant food by a discussion of its practical results by Dr. James R. Nichols of Boston, in the Boston *Journal of Chemistry*, and subsequently in the agricultural reports issued by the general government from Washington, wherein he states that on a worn out farm of one hundred acres, on which only ten tons of hay were cut annually, he put only one-fourth of the farm under cultivation, and at the end of seven years he was keeping eighteen cows, five horses, three hogs and a part of the time a yoke of cattle. And he effected this change in its productive capacity by the use of artificial fertilizers without animal manure. He employed various fertilizing agents, one of which was what he styles a farm-made superphosphate, made by grinding bones and mixing it with sulphuric acid, commonly known as oil of vitrol; other articles he used were fish pomice, lime, pure ground bone, crude potash and small quantities of sulphate of magnesia, which is familiar to us as epsom salts; he used also nitrate of potash, which we all know as saltpetre; and he employed chloride of sodium which is our common salt. Among instances which he furnishes of his treatment of single acres he mentions plowing an acre of poor upland in the fall, and the next spring applied five hundred pounds of pure fine ground bone, sowing it broadcast, and planting it with corn, putting a handful of his farm-made superphosphate in the hill, from which he harvested seventy-eight bushels of shelled corn. After the corn was removed the land was plowed and dressed with eight hundred pounds of a mixture of ashes, bone dust and refuse saltpetre, and sown to rye, from which he harvested thirty-one bushels of excellent rye. For a period of five years his corn crop never fell short of seventy bushels of shelled corn per acre, and in some instances reached as high as one hundred and six bushels per acre. And he claimed the aggre-

gate cost of raising it did not exceed forty-five cents per bushel. He would sometimes use a mixture of bone meal, ashes and lime, and on some of it phosphoric acid, potash and lime. He plows his land in the fall so that it will become more completely pulverized by frost. Of wheat he raised thirty-one bushels per acre by sowing broadcast five hundred pounds of farm-made superphosphate mixed with one hundred pounds of crude saltpetre and fifty pounds of sulphate of magnesia, better known as epsom salts. He found by analysis that the ash of the wheat plant consists of one and one-eighth part of the magnesia. Three tons of hay and three hundred bushels of potatoes were raised on land on which not a pound of animal manure had been placed. And after years of careful experiment he concludes that all of the elements of plant food must be present in the soil: and he believes that poor land can be renovated and kept in good condition for any length of time by using chemical fertilizers.

My own experience in the use of phosphate bought of the dealers has not been extensive, and, with one exception, has proved unprofitable; but I am frank to confess that I did not use it altogether as I had been instructed by the experience of some others. My first experience was in 1877 with potatoes, applying it freely in the hill; the season was very dry, the crop early looked fine, but soon failed and hardly paid for digging; that season the potato crop was generally poor on nearly all land. I used the same method the next year, putting in the hill for corn at least eight hundred pounds per acre and got large stalks but little grain. The season just passed I varied my method by mixing with the phosphate an equal amount of plaster, furrowing the ground, putting the phosphate and plaster in the hill, and dragging a heavy bush through the furrows so as to distribute and intermix it with the soil, but like my former attempts the crops did not pay expenses. On a part of the piece where *ashes* and *plaster* were used my crop was better, which fact revealed that potash was needed on that part of the farm. The land selected for the above test was the poorest I could find and naturally dry, being gravelly, upland loam. The phosphates used were the Stockbridge and the honest fertilizer made in Buffalo, N. Y. On a piece of hard pan, naturally moist, I last season planted corn, fertilizing in the hill with the Quinipiac phosphate, mixing it with the soil with the hoe when planting. On that piece my crop was easily doubled, if not more, the fertilizer proving highly remunerative, which I attribute in part at least to the moist condition of the land, for it is well known that it is necessary to bring all plant food in the soil into a state of constant and gradual solution to allow it to be absorbed by the rootlets and conveyed through the plant and become incorporated into its substance.

I entered upon the employment of phosphates with high confidence, and was quite disappointed in the results, and I apprehend there was a large mistake in my method of using it. Though the testimony of some is to the using of *phosphates* with no profit, the testimony of many intelligent men is that chemical fertilizers are highly beneficial. And knowing the accuracy of chemical science, and having the assur-

ance from many trustworthy sources of the practical success of chemical plant food, I am not at all discouraged, and am confident that when a better general understanding of methods of application and of the varieties of chemical plant food required for the different soils abounding on nearly all farms, is brought to bear upon the art of agriculture, that results will be achieved fraught with great good. Already in some of the most populous centres of Europe the question of food supply is attracting the attention of thoughtfnl men, and the time is ultimately coming when the numerical growth of population in the enlightened nations will give the question of a *varied* and *generous* food supply a serious importance unless science and art co-operate in agriculture to prevent such a misfortune, and the suggestion arises that present pecuniary interests as well as the pleasure of taking steps forward in practical knowledge, which may be of use in the distant future, may reasonably impel us all to try by careful and persistent experiment to discover the resources which chemistry affords for elevating the science and art of plant cultivation to its highest possibilities, and we are apt to think that the time will come when the use of chemical plant food will be as well understood and as commonly applied as the present familiar habit of crop culture.

FRUIT CULTURE.

An Address delivered at the Springfield Institute by F. W. BLANCHARD of Weathersfield, Vt.

In presenting a subject of so great interest as this before this meeting I feel that there are many who have had a greater experience in this branch of farming than I have, and who might have more properly been chosen to fill this part of the programme.

As we glance back over the ages that are past and gone, that are known no more to the present generation save in a historical sense, we find that the growing of fruit is as natural a production of the soil in which the particular kinds are adapted, as is the grass that grows in our fields, or the trees that grow in our forests; and it seems just as natural for the men and women, boys and girls of the present age to have a longing after apples and a desire to taste of them as did our first parents in the garden of Eden.

How few people there are at the present time who would be able to withstand the temptation that poor old Eve was called upon to undergo, after once knowing the pleasure that is to be had in partaking of a good liberal meal of rich, ripe, mellow apples, that seemingly have been flavored to one's own particular taste; or a dish of ripe juicy pears which seem to be waiting for some one to devour them, or a few clusters of ripe grapes which, as they are picked from the stems and separated from their skins, seem to pass down one's throat without any apparent effort of the partaker!

Especially do we find it so when so many families are deprived of such healthy and almost necessary luxuries, as there are this present winter, owing to the scarcity of last season's crop. But such years are exceptions, and they should not be allowed to discourage any one who has an acre of land from trying to grow enough for home use and in most years some to spare. It is an interesting fact to know that fully one-half of the fruits that we cultivate are not native to our own particular locality, but have become quite hardy and productive by acclimatization, thereby producing fruit liberally in different climates and in different soils, being stimulated by the vigilant corps of nurserymen.

I believe that we are only in the beginning of these remarkable changes, and the introduction of new varieties into different localities from which they naturally grow will yet be productive of profit.

How amusing, as well as interesting and useful, it is to compare the fruit that grows on our grafted and well pruned trees of to-day with that produced from a native, untrimmed tree growing right by the side of the former; equally so is it to compare the currant and gooseberry with their parent stock; again this fact is more fully illustrated by viewing side by side the fruit that is found on our old wild native frost grape with our new varieties that are to be found in almos every garden.

Those and many other comparisons of a like nature go to show what agriculture and science are doing, and to those who are engaged in other vocations what the hard, untiring labors, deep thought and energy of the farmer is producing not only for himself but for those who are permitted the pleasure of enjoying his fruits and labors.

It seems to me that the majority of our farmers are making a great mistake in this particular branch of agriculture, in not giving more attention to the cultivation of fruit of various kinds.

There is no part of the whole year that is enjoyed so much by the boys and girls as is the season of gathering the different kinds of fruit; and there is no part of the year in which the children of farmers can render so much assistance as during the harvest. I believe that if every owner of a farm would take a portion of it, and set out some apple trees in one place and some pear trees in another, a small vineyard in another, not forgetting the currants and berries of different kinds, that they would, after a few years, find it remunerative, and would also find that the children would be more willing to remain at home, and follow the occupation of their parents; and those who did choose to go, would wait with impatient longings for the return of each harvest year, when they could visit the homes of their youth, and enjoy for a season the pleasure of roaming over the hills and through the valleys, gathering and partaking of the fruits which they so much enjoyed in their childhood days.

What a mine of wealth it would be to New England if its farmers would cultivate their farms with such an end in view, thereby retaining more of our young men and maidens in their native towns.

The desires of the young men of to-day are changed, most radically changed, from what they were fifty or seventy-five years ago, and if those desires could be gratified, (which I claim that in a measure they might) then we should not see so many abandoned farms, so many elderly couples living on the old homestead, where they are plodding along in a lonesome, weary way almost entirely alone; and if you perchance drop in and enter into conversation with the aged couple, they will tell you that their children have all left them, and are seeking their fortunes in some city or state not far distant, or have gone west to help build up the new states and make homes of their own. Now had those parents used a few of their spare dollars and leisure hours in the procuring and growing of those delicious fruits which might have been procured, even in those days, and had kept adding new varieties from time to time, as they were brought forth to the public by the diligence of our nurserymen, I predict that so many aged couples would not be obliged to close their days without their children. Perhaps you may say, that it would make no difference, that our young men would leave and seek their fortunes elsewhere.

Well, for the sake of argument, we will admit that a portion of them, at any rate, would be obliged to leave from the fact that there would not have been homes enough in the east for all, but would not those farms have been worth enough more to the owners, to have fully compensated for all the money and labor spent on them when they came to sell, while those same farmers would have added

greatly to the wealth of the town by keeping those farms occupied rather than to be turned out to pasture, as is the case with very many?

I know of a farm in our town (and most likely there are those of a similar kind elsewhere) that would ere this have been used simply for grazing, and the buildings have been demolished had it not been for the efforts of one of the owners of the farm about thirty years ago, who, being a lover of fruit, set out a few acres of apple trees of good varieties; and as a result that farm is ranked as one of the most productive in town. Notwithstanding its unfavorable location, as long as the orchard that it contains continues to yield an abundance of fruit, it will be a desirable farm. What a treasure it would have been to our town if more farmers had done likewise.

If you are the possessor of a good, easy tillable farm, on which you can use a good share of the modern farm machinery, it would be well to raise grain. If you have a naturally good grass farm, raise grass, but on either of these farms don't forget to grow at least a sufficient quantity of fruit to satisfy the demands of your own family; unless your farm is vastly different from most of our Vermont farms, you will find a half acre or more which can be used for fruit, and that not to the detriment of any other branch of husbandry that you wish to pursue.

As one is riding through almost any of these towns in the fall of the year, he cannot help noticing what a large per cent. of apple trees there are that bear nothing but small inferior cider apples; very many of these trees being quite young and thrifty. By the judicious use of the ax, saw and engrafter, with proper care and a little work each year for a few years, those trees would be a source of profit.

It is claimed by some that this common fruit is worth gathering for feeding purposes, but why not grow larger ones, as the expense would be but a trifle more, and would be fully offset in the gathering, saying nothing about the extra value that would be obtained from the marketable fruit. I am something of the mind of the late J. B. Davis of Weathersfield, who said that he thought the poorest paying business that the farmer engaged in was to grow cider apples, hire help to pick them; hire them drawn to the mill; hire them made into cider, drawn home—put into the cellar, and at last, to hire help to drink the cider.

What a truth! Yet there are very few farmers who have not done the same thing. But within a few years other and better ways have been devised for the use of second and third quality fruit which every one should welcome and give a hearty support by discarding the old and adopting the new, that is evaporating apple and making apple jelly.

Suppose we sit down in our homes some of these long winter evenings and study over this fruit question on our several farms, and see if we have not got ample room to grow all of the different kinds of fruit that this Vermont soil is capable of producing, and do it without disturbing or hindering the growing of all field crops that the common farmer attempts to raise.

Have you any apple trees growing in your fields, by the fences, by piles of stones, or by the road side? If so, graft them. If not, isn't there one corner of your field that you do not especially need for tillage, that would make a nice orchard in a few years, provided that a few dollars were invested? It would pay a better interest than the same amount in any of our savings banks or trust companies. But if that corner cannot be spared, there is one place that can be, and that is by the side of that fence, by the roadside, though it would be far better to take one, two or three acres, just as your means will permit, prepare the ground and set your trees and care for them for a few years, until they get thoroughly rooted, then in after years you will obtain reward.

Have you as many pears as you would like, even for home use? If not, you will find ample room, and one of the best and surest places to grow them, on the north side of your house, shed or barn, where they will thrive much better and live longer than if they are set where they will receive the direct rays of the sun in early spring, which by thawing and freezing shortens the life of many a tree. Every owner of a house and garden has room for at least one half dozen trees of either pears or plums, and perhaps both, on which nothing else could be grown with such good results.

How about those grapes that everybody is so fond of. Just take an imaginary look over your fields, and most likely you will find very many places where the vines might be set, and they would thrive admirably. Such places, as by the side of stone walls, stump fences, large boulders, or by the side of protruding ledges, where the vines can have ample room for climbing, and which makes a place where the fruit will ripen at least ten days earlier than the same variety will do in a less favorable situation.

How easy it is to utilize these seemingly useless, unavailable places which every land owner has on his premises, and very many times has more than he wishes he had. From the fact that different soils and locations are needed in order to thrive well, we see there is hardly any spot or place, even on the rough and rugged hills of our much loved Green Mountain State, but what can be used to advantage in growing some fruit, tree, plant or herb which will help to supply the wants, gratify the tastes, or alleviate the sufferings of its inhabitants, when properly understood, studied and used.

We have not such broad and extended areas over which to extend our labors as have our western friends; hence, we have to look with searching eyes after these hidden treasures which are year by year being unfolded by the almost untiring energies of the never satisfied Yankee, and when found, use them to the best advantage possible; and our state will continue to hold a front rank among our more alluring states.

A man cannot improve his farm so much in any other way, that is, make an improvement that will last as long, that will pay as well, as by planting an orchard, and by bringing into bearing all seemingly worthless trees.

If a man of limited means buys a farm, and does not have the cash to put these improvements all in at once, it may be accomplished with

equally as good, and perhaps better, results, by doing a little each year, which will in time bring about the same.

To those who are thinking of setting a young orchard, and not knowing how many trees it would take for an acre, the following rule may be of use to them: Multiply the distance in feet that the trees are to be set apart in the row, by the distance in feet that the rows are apart, and divide the number of feet in a square acre (43,560) by the product thus obtained, and it will give the number of trees wanted to set on an acre. By the same rule one can ascertain how many plants or hills of any kind are grown on an acre or any given space.

In setting trees, or grafting the same, one ought to avoid putting in too great a variety, just enough for home use, adhering strictly to some hardy standard kinds for market purposes, as one's success depends largely upon the selection of varieties which succeed best in the locality in which they are grown. For market purposes and for good bearers, none will be found better than the Baldwin, Rhode Island Greening and Bellflour for winter; and for summer, the Red Astrachan is superior to any other variety for either home use or for market. The Porter comes along about right to fill the space between summer and winter fruit, but for transportation it is not good, owing to its color. Many other kinds might be mentioned which are good bearers, but would not prove as profitable as those before named. The Bellflour will succeed best of all on dry soils. In setting trees, great care should be taken to have the roots occupy as natural a position as when they occupied their original site. The soil should be well worked in around the roots, and made firm by the hand, especially under the base of the tree, so that the ground will not settle and leave a hollow space under the roots and at the bottom of the tree. If that is allowed, there is great danger of losing the tree during the first summer, which is caused by the air working in and drying up the roots. Soil that is in a fair state of cultivation is in good condition for the growing of trees, and they will thrive better than when manure is put in the hole around the roots. If any fertilizer is to be applied, mulching will do the most good.

I once set fifteen trees and used nothing at the time of setting. They all lived but made a very slow growth the first year. Late in the following fall I spread some refuse straw around each tree, and the next year they made a strong and vigorous growth.

PRUNING.

We are very apt to leave too many branches on young trees when they are first put out, as they make too heavy a draft on the few roots that are left on the tree. Prune thorough at this time. Too much pruning the first year after trees have been grafted is injurious, and for the first year all that is necessary is to keep the sprouts around the stubs all cleaned off, which can be done by going over them twice during the year; the second year cut away the larger branches that were left by the engrafter, also the sprouts that grow during the year; and the third year the balance of the old top may be cut away. Some recommend that all, or nearly all, may be cut away the first year, but

my experience teaches me that such a course is wrong, as it causes such a check to the circulation of the sap, and as it admits the direct rays of the sun on the body and limbs of the tree, it will often kill the tree outright, or cause the body to be killed on that side exposed to the sun.

Always trim from the 1st to the 20th of June, if you want the wound to heal over in good shape. The half has not been told that has to be done, in order to make a success in this matter; as in fruit raising like all branches of farming, there are a thousand and one little things that have to be done, which, if they are neglected, will result in nearly a total loss to any one who attempts it. An interesting article on that subject might be written on "Small Fruits," but owing to time and limited experience this part will have to be deferred.

Being much interested in this work, I put out last fall fifty grape vines of the earliest varieties, also fifty plants of black raspberries, thinking that these fruits may be grown at least with pleasure and enough for home use if not for profit.

Owing to the roughness of a great share of New England, the comparative hardness with which its soil is tilled and the cost attending its cultivation, very many farms might with profit be turned into fruit farms. It would give more variety and life to our employment. It would cause our tables to be more bountifully spread during all seasons of the year with those delicious fruits that are so tempting to the appetite of every one. It would cause more of our young men and women to be satisfied with farm life, by feeling that they would not be obliged to follow along in the old routine of ordinary farm work, while so many flattering stories are being told of a life of ease and wealth which can be attained without labor, by rushing into our over-crowded cities, or by going west and engaging in stock raising or some of the speculative operations which are so fascinating to those who are of a roving and discontented nature.

But every one will not go west, neither do all succeed who do go, any more than all can live in the cities. Although New England may lose some of its enterprising young men, it will never become extinct. It has too many beautiful homes and villages, too many local attractions which are not only charming and attractive to their owners, but are drawing thousands of tourists each year, who pay their annual visits to this Switzerland of America.

It is a fact that some of the more inaccessible localities of New England would have been worth more to-day if they had never been cleared by the first settlers, not only from the worth of the timber, but from the influence those forests would have on vegetation. Yet there are many localities that are so favorable to the production of fruits, and other farm products, and the demand for them in our villages and manufacturing centres so great, that they will not be abandoned, and there is no locality in the known world that will produce such a variety of fruits and vegetables as will New England. Why for one moment entertain the idea of finding any place where more luxuries can be had from one's own labors! We find our hillsides and valleys dotted with pleasant homes, from whence did they spring

and how do their owners obtain their support? They are the result of the labors of those who have been willing to remain here in Vermont.

This country has passed through, within a few years, one of the most trying ordeals that any nation was ever called upon to encounter, and from the fact that there was less failures among the agriculturalists than among any other class, it most surely ought to actuate more of our young men to follow that occupation. The money so earned is good honest cash, and no one on the face of this broad earth is any the poorer for all the money so accumulated. Let us hail with joy the introduction of all labor saving implements, both indoors and out. Let every farmer use all such as will lighten his labors. It will have a stimulating and encouraging effect on the boys, and will remove many of those discouragements which tend to drive so many from the farm. Many who have gone may in time be glad to return to their old homes, and regret the day that they left them; while those who still remain, if they do not choose to raise fruit to supply other countries, may be able to send out good, true noblehearted men and women, and also have enough left at home to maintain the standard and integrity of the old Green Mountain State.

"THE KEY."

An Address delivered at the Poultney Industrial Association Meeting by Miss Nellie Stoddard.

The massive gates of circumstances are turned upon very small hinges, and often a little spring, or a tiny key, will open them to our longing eyes. Earth has many treasures, both rich and rare, but they are carefully concealed in secret places, and there are keys which lock them from our sight. As the geologist digs deep and finds fossils of things unknown at the present time, does it not open to him a wide field of thought and duty? Is not much of ancient history locked up in oriental ruins? For long centuries Pompeii and Herculanium concealed from mortal eye the history of their past, but Schliermann applied the key which revealed to the wondering gaze something of the splendor and glory of those ancient cities. With what interest does the traveler wander among the mouldering mines of Alhambra and Melrose! How one loves to linger in Rome, recalling as he visits the Coliseum the former greatness of this once "queen of cities!" On every hill-top, mountain-side and valley is there not a mantle of beauty? In the grassy slope, by the babbling brook, the velvet mosses, the unfolding flower, sparkling with dew-drop diamonds, as yet unscattered by the approach of Aurora's flaming chariot. The wondrous shells of the ocean, the exquisite blending of the colors of the rain-bow, the varied hues of the morning and evening sky? Is there not beauty, yes, even sublimity, in the deafening roar of the cataract, the deep bass of the ocean's restless waves, each striving to surpass the preceding in height and power? Is there not sublimity in a thunder storm when all the elements are raging? The peals of thunder reverberate from peak to peak, and join in re-echoing the mighty chorus; the vivid flashes of lightning shoot across the heavnes, now lighting the landscape with fitful glow, and leaving the sky dark with black clouds. And yet, all this beauty, all this sublimity, is as naught to the careless beholder. Invisible guides are stationed all along life's pathway, pointing out the way through the labyrinths of pleasure and woe. The restless, hurrying throng seize first one key and then another, thinking each one must surely reveal the long-sought object of their search. Folly and self-pride, "the springs which actuate the soul," give access to the temple of vanity, where her votaries enter, and at whose shrines they pay due homage. Ambition leads to a well-trodden path where all looks sunny and inviting; the road is shady and lined with beautiful flowers, but beneath the fair petals are stinging thorns, and danger hovers around with threatening power. Rushing impetuously forward, allured by anticipated success, many find themselves on the verge of a steep

precipice bordered with variegated blossoms; on and on they go, nearer and nearer the edge, until losing foothold, they sink down, down, into the yawning gulf below. Many a glad, happy youth wends his way to the temple of Fame, hoping to win a starry diadem, but, alas! he finds there awaits him disappointment and woe instead of the long sought honor. Pleasure, arrayed in costly robes and glittering gems, stands at the gate with crimson chalice, beckoning the crowd hither and offering the poison. They quaff the foaming liquid to find it the cup of bitterness. There is one key that, on account of its beauty, attracts all men towards it; this is, the shining, golden key. It hath been said, there is no lock that it will not fit, no door that it cannot open, and it is, indeed, too true. All classes, the lowly and the proud, all ages, all countries, *all* strive to possess it. It opens to the politician the gates of office, for it turns many votes just by its lustre. It throws wide open the doors of many homes to the base and ignorant who could never gain access without it. It protects its possessor from criticism, it conceals multitudes of imperfections—yes, of sins. But he who would enter any department of art, science or literature must remember that "*Labor omnia vincit.*" Labor has been, is, and ever will be the key to all intellectual greatness, to all glorious results. Hard toil laid low the mighty forests where our cities to-day stand. It has made a net-work of railroads to span the continents; has placed the massive cable beneath the waves of the ocean, enabling us to commune with our sister nations. Labor has tunnelled through the solid rock, mined in the deep recesses of the earth, depositing the boundless treasure at our feet. Long years of toil have enabled scientists to so well understand the movements of the heavenly bodies that the coming of a comet can be accurately predicted many years in advance. It is labor that opens the door of learning to the student, letting in the light of knowledge and driving away ignorance and superstition. It is labor that makes a weak people a mighty nation. It is labor that saves from intemperance, sin and ruin; but great and strong as is this power, there are recesses in the human heart which it cannot reach.

> "No mortal thing can bear so high a price,
>   But that with mortal thing it can be bought;
> The corn of Sicil buys the Western spice.
>   French wine of us, of them our cloth is sought.
> No pearls, no gold, no stone, no corn, no spice,
> No cloth, no wine, of Love can pay the price."

No; this casket of love in the heart cannot be opened by gold or rubies, by pain or labor, but it may be unlocked by kind words and loving deeds. The criminal in his prison cell, the drunkard at his wine cup, the profligate with all his vices, each may be reclaimed by love answering back to love. If he who carries this magic key unites with it those of Faith, Hope and Charity, bound by the pearly chain of Virtue, he need not linger long at the gates of Paradise, for they will open wide and admit him to the Celestial city.

FARMING.

Delivered at the Agricultural Institute, by H. E. PAUL, of Wells.

If this paper I have been invited to read to you has any merit it is brevity, and being rather dull and pointless will afford a variety and furnish a background so that succeeding papers of abler men will appear in a better and brighter light—just as a sunshiny day following a dull or stormy one is more beautiful.

As we take a retrospective view of this subject in the light of experience, we discover in the first place in our own town a smaller number of farms, consequently fewer farmers, than there were some fifty years or more ago; the more industrious and successful having absorbed the land as soon as it was ready for sale. Now, what is true of our own town we think more or less applicable to neighboring towns, and in fact to all those States which have been tilled for half a century and upwards.

As a result, we learn that the soil of those large farms has very much deteriorated in value, within the memory of our oldest farmers. Now in this connection, although foreign to our subject, we ask candidly: Is this process of absorption to continue until the land of this country like that of Great Britain is owned comparatively by a few individuals?

In our review of the past, we discover in the second place, genererally speaking (for there are exceptions to all rules), that our smaller farms also are not in that high state of cultivation which we all should fondly hope to see. It needs only a passing glance as you travel the highway in summer to convince yourself of this fact.

Now, who shall tell us how to pursue farming on correct principles and take us back to the point we have lost, viz., of producing two blades of grass where we now do one. For, one who sells the larger part of the hay and grain his farm produces, considers that he is right; while on the contrary another remarks that he is not going to take his farm to the city one load at a time. Another considers that it is best for his farm to raise beef for market. But in either case, and in fact by most of our farming as at present conducted, are we not robbing the soil of some of its most necessary ingredients for the growth of plants, and thus becoming land poor?

By robbing, we mean that we do not return an equivalent for what we take from the soil. Are we keeping the amount of stock in our town that we ought considering its size? How many farmers and others conducting farms in town can say that farming pays? Perhaps they are getting a living (for we have not as yet heard that any farmer in this vicinity has died of starvation), but are they doing as well as they ought?

Is there no remedy for the ills which have fallen to our lot? Time will tell. Firstly, from a humanitarian point of view, which considers the greatest good to the greatest number, we, as a nation of farmers, on whose success depends the success of so many of our national industries, should be united in a policy, the tendency of which will cause manufacturiug establishments to spring up, and thus utilize the great water power and privileges which this country affords.

Then as a natural result, farmers will find a market for their surplus near their door with corresponding benefit. Who will consider that it pays equally well to dispose of produce one hundred miles or more from home when at ten miles it can be sold for the same money? Consider for a moment the practice of sending millions of bushels of wheat some three thousand miles from home, paying the cost of transportation, and then taking in exchange costly goods manufactured in a foreign country. Will not such a policy take the life blood from our soil? Suppose that everything goes well now, so long as we export more than we import, how long, we ask, can such a policy hold out?

If this saying be true, viz., that "westward the star of empire takes its way," then is it also true that the *wheat belt* of this country is taking the *same* direction, and if we are to judge the future by the past, will soon reach its terminus on the shore of the Pacific ocean.

Oh, farmers! Shall we live for ourselves alone without regard to posterity? We fear time will show that in this respect we were not wise in our day and generation. If it is not visible now, it soon will be—the necessity for a change, viz: That we should manufacture more of the raw material produced in this country, and consume more of the grain product of our soil. Then will a point be reached that will be of some practical benefit to farmers. Secondly, to return to our own vicinity, and dropping the question whether fifty acres or five hundred is sufficient, we need to adopt some plan that will tend to restore our soil to its former fertility. Much of our soil is in the condition of a man reduced by sickness, and needs something nourishing and strengthening.

Who knows but the system of ensilage, now springing into existence, may prove to be one remedy we need? If by its adoption we can keep two cows where we now do one, and cause two blades of of grass to grow where one now grows, the desired result may be obtained.

At least, as the prospect is, we shall sooner reap benefit from this plan than the one before mentioned. The sugar beet industry, we hope, may eventually prove another remedy for us.

In this brief and rambling review of farming, with suggestions for its needs, we shall be pleased if we have furnished any matter for your thoughtful reflection.

"DRAINAGE."

An Address given at the Springfield Meeting by J. R. WALKER.

In opening the discussion on drainage, in this short paper, nothing original is claimed. The art of freeing land from superfluous water, by means of covered drains, or causing it to flow off in channels, or through porous substances, is not of modern origin, but dates back far into antiquity.

The Romans were well acquainted with the art of draining, and appear to have practiced it to a great extent. Their writers on agriculture, Pliny, Cato, Palladious and Columella all mention it; and some of them give very minute directions for the formation of drains, with stones, wood and straw. Various remains of ancient drains in England show that land draining had been practiced there from a remote period. About the year 1650, Captain Walter Bligh published a work in which he not only gives directions for "systematic drainage of watered meadows, bogs and marshy grounds, but founds his rules upon principles, which the latest experience and most scientific researches have shown to have been eminently correct." In 1764 Elkinton, a farmer of Warrickshire, established an original system of drainage, in which, he was himself, remarkably successful in tapping and drawing off water from springs in a few deep ditches. (His system, however, did not contemplate the removal of water occasioned by rains.) In 1823, Mr. James Smith of Deanster, introduced the system of frequent, or thorough drainage, which, in fact, was the same as recommended by Captain Bligh nearly two hundred years before and is the system now adopted by our most successful engineers and practical drainers. It consisted, in short, of constructing a series of parallel underdrains in the direction of the steepest descent. At the bottom a main drain was made of sufficient capacity and descent to convey away all the water collected by the smaller drains.

Underdrains were formerly made with stones, timber, brush and even weeds at the bottom, and covered with soil. These materials are fast giving place to drain tile, which is decidedly the best, and the cheapest, where tile can be obtained near where they are manufactured, or at reasonable rates. The first machine for the manufacture of tile was invented by the marquis of Tweedale. In 1835, tiles were introduced in this country by John Johnson of Geneva, N. Y., a Scotchman by birth, who imported patterns of drain-tile from Scotland, and caused them to be made by hand labor to be used upon his own farm. In 1848, John Dalafield, Esq., of Seneca Co., N. Y., imported from England a patent tile machine. Since that time tile draining has been diligently pursued in that part of New York, and

so well are the land owners pleased with the results, that upon some single farms, in that vicinity, more than fifty miles of tile underdrains have already been constructed.

An instance of the value of drainage upon a wheat crop is related. During a year when the wheat was badly affected by midge, upon seven farms adjoining not drained, only nine bushels of poor wheat per acre was obtained. While upon the drained lands of Mr. Johnson, twenty-nine bushels per acre of fine wheat was harvested. This one crop would pay the entire expense of drainage and leave the land in fine condition to produce large, heavy crops in all future time. But th nine bushels from the undrained land would not pay for cultivation. Let us glance at some of the many advantages of underdraining.

1st. It lessens or prevents the injurious effects of drouth. There is no danger of making land too dry by underdraining it. It is a fact, fully established by experience, that thoroughly drained land is less liable to suffer from drouth than those that are undrained. It is the common observation of farmers that wet lands are sooner affected by drouth, than those more dry and porous. The former bake and become hard and compact in a dry time and do not readily absorb moisture from the atmosphere; but a well drained, well pulverized and porous soil, absorbs like a sponge and receives into its pores the dew and watery vapor of the air. Hence, the benefit in a drouth of deep tillage and subsoiling on land naturally or artificially drained. The moisture descends to the lower portions of the soil and is then taken up by the rootlets that permeate it in search of food. Subsoiling upon wet land is of little benefit, as the subsoil, when thoroughly saturated, soon settles to its original hardness and while loosed has a greater capacity to retain water, thereby rendering it cold and unproductive. It is chilled by evaporation; soils that retain water are correctly called cold, while those of a more sandy and porous nature are called warm. They are warmed below by the rain water which percolates through from the surface, and are heated by the direct rays of the sun. Drainage renders soils earlier in spring, it allows us to work sooner after rains, and keeps off the effects of cold longer in the fall, thereby lengthening our seasons. It raises the temperature and thus produces the effect of a warmer climate.

By the experiments of Mr. Parks in a bog in Lancashire, it appears that by giving free passage to the water through drainage, its temperature, at the depth of seven inches, may be raised to ten degrees above that of undrained adjoining land of the same quality.

It improves the mechanical texture of the soil, and hastens the decay of vegetable matter. These are some of the benefits to be derived from drainage. Most farmers are willing to acknowledge its utility, but the question arises, "how far is it advisable in Vermont?" When contemplating any farm improvements the first question that naturally suggests itself is, "will it pay?" That wet land is greatly benefited by underdraining, is very well understood, and generally conceded by all intelligent farmers. But whether such improvement would pay is another question that admits of no general answer.

There is some land in Vermont that will pay well for draining, and there is a great deal that might as well be let alone. Drainage is an expensive operation, and it depends upon circumstances whether it can be done at a profit. Where good land is worth $50 per acre it might be profitably drained. But if land is very cheap, it would be a questionable outlay. There is much land in Vermont that would be improved by drainage, that cannot be profitably drained. The question whether it will pay depends upon the value of the land before drainage, the cost of the operation, and the value of the land when drained. It also depends upon the crops you wish to raise upon the land. If you wish it for a vegetable or flower garden, to raise Indian corn or wheat or for a market garden, it would be advisable to thoroughly underdrain it. But for a grass crop it would not pay the outlay. It might be better to top dress and keep it in a permanent grass crop. In general, perhaps underdraining may be considered a question of profit and loss. A farmer who has money to loan at six per cent., if he can by underdraining his land cause it to produce enough more to pay him the interest on his investment, can afford to do it, as his capital will be safely invested in real estate.

I do not believe with the late Horace Greeley that all lands that are cultivated require draining. It will be a long time before the farmers of Vermont will invest much money in draining gravel knolls. Much of the land in this part of the State is naturally drained, or so nearly "dry enough," that it would never pay to underdrain it. There are some meadows that are too wet in spring and fall perhaps, that produce heavy crops of grass annually. Bogs and marshes must be drained or not cultivated. Where a suitable outfall can be secured it is a profitable investment. Slopes of hills, with a subsoil nearly impervious to water, and having different strata, between which the water from the highland above works out and saturates the soil, will be greatly benefited by underdraining. The most of my draining has been on land of this description. An open ditch or catch-water was made at the upper part of the field to prevent the surface water from above flowing over it. The ditches were sunk up and down in the direction of the steepest descent thirty inches deep, and about two rods apart. Some of the drains were laid with two inch sole tile, and the remainder with stone found upon the field. They have continued to discharge water freely for twenty years, and I cannot discover any material difference between the tile and stone.

The drains upon these farms are constructed of stone, with a board at the bottom, and the drain, which is like a culvert, is made large to prevent clogging. An open drain is better than none, but a covered one is far better. Stones dumped into a ditch without making the culvert are sure to clog soon and become worthless. The first two crops more than paid the whole expense of drainage, and I have since had a productive field, in place of a nearly worthless one.

Messrs. J. R. Gill, Spaulding and Whitney of this town, who have done extensive works in drainage on their farms, through which runs a trout brook, and three crops at most has paid them for the entire cost of drainage. Some of the land upon these farms was so wet and soft

that a team could not be driven over it, and the poor hay was carried off on poles. It is now comparatively dry, and among the most productive land in town. Instances of the good effects of drainage upon crops might be multiplied, but it is unnecessary, it is generally conceded. There is prose as well as poetry in underdraining. The rural poet may write in flowing numbers of the beauties of drainage, and laud the man who causes two blades of grass to grow where but one grew before. It is pleasant to talk and write about. Figures show it to be profitable as well as philanthropic and poetical. But when this flowery poet takes the initiative of real labor, dons the short frock, overalls and rubber boots, walks into the ditch of mud with one foot stretched before the other and there wields the pick, or plies the spade from "early morn till dewy eve," he will find the poetry of drainage oozing out his finger ends, and the whole subject will assume a very decided prosaic appearance ; and unless he can let the job to some one who can dig better than they can write, drainage, with him, is among the things that were talked about.

Do not expect to drain yonr land without solid hard work by somebody. Use a team and plow to open down as far as practicable. A man with a good team, and a plow, will loosen more dirt than ten men can with picks ; cover the drains with a team and scraper ; provide yourself with a copy of some standard work on drainage, and, if your work is extensive, consult a practical engineer. Do not be deterred from improving yonr land by drainage because there is hard work in it, but persevere, remembering that most of the desirable ends of life are reached by the free use of courage, muscle and brains.

Mr. Lane of Cornwall likes stones put in loose for drainage. W. B. Rice thinks they should be set arching at bottom of ditch and then filled in above. General opinion was that on account of moles, tile was the best.

A BREAKFAST TABLE TALK.

Delivered at Middlebury Institute by Prof. Henry M. Seeley of Middlebury College.

I wish the farmers of this audience to be interested in a discussion which we—a farmer and I—had one morning over a plate of buttered toast. The questions that arose, were some that have often been touched upon, but not in all cases fully answered.

The Board of Agriculture represented here to-day, have spread out good things before you, and you have been feasting on them; let me take you to the table, where my friend and I took our morning meal.

First of all we discussed the toast; the toast itself, the slices of spongy bread, delicately browned, and creamed over with yellow butter. Why was it, we questioned, that we had toast at all; why was it that we were not eating parched wheat, as did our very remote ancestors, or at best, eating their unleavened cakes, prepared from a coarse meal made in a mortar, as did our ancestors, not quite so remote?

We cast a backward glance and took in the work and ways of the old time, and far away husbandman. We, through the dimness of the past, saw him on his little plat of ground, on the bank of a stream, stir the soil as best he could with a stick, scatter there with sparing hand the grains he could poorly afford from his small store, watch his crop with jealous eye while growing, carefully gather the heads with his hands when ripe, beat out the grain with a stick, separate the chaff by tossing up into the air, then storing the scanty harvest in the skins stripped from his slain beasts, then from time to time when the fish from the stream, or the game from the forest failed, he doled out from his treasure, for himself and family, the handfuls which were roasted or parched before the fire. This fare of parched corn was, perhaps, varied by the work of the faithful wife, who baked a cake on coals from the meal she had prepared in the mortar.

We took this all in, I say, at a glance, and asked how it was that we were not eating the heavy cakes instead of the buttered toast. After some discussion we answered the question in this way: It is largely because we have brought the powers about us and the forces of nature to our aid, making them do our work for us. We have abandoned trying to do everything with our own hands; we are laying hold of eternal helps. By the proper use of our minds, we are making things bend to our aid. We are using such powers as nature places in our hands. We seize upon the wild animal, and taming him, make his strength our strength. We bring to our help mechanical power, and by such services alone, or harnessing the brute to our implement, we combine brute and mechanical force, and so augment our power a hundred or a thousand fold, and do what otherwise would have been impossibilities.

Take this slice of toast as a text for instance, and follow the history from the seed sowing until it comes as an appetizing morsel to our plate. We will not stop over the way by which the forest has been made to give place to the broad, smooth field, but will follow the work of the farmer and the farmer's wife, for the preparation of the soil, until the bread comes from the oven. In turning over the soil a common plow or more likely a sulky plow is used, drawn by an alert team; the harrow softens and smooths the freshly plowed land, the drill quickly and safely buries the seed, and the crop is cared for, except in keeping off intruders until harvest time. Then the reaper with the binder quickly make the sheaves, the threshing machine with its attached fan sends the winnowed wheat to the sack. The miller sends back the finest flour to the storeroom, and from the well kneaded dough comes the loaf which the kitchen range gives back with its delicious browned and tempting crust.

From first to last the processes have been done almost wholly by machinery. Only the guiding thought and hand of man have been necessary. Powers other than that of man have been called into requisition, and the outcome has been the delicate wheaten loaf, and its possible consequent, the browned and buttered toast.

You should have heard my friend as he took fire and glowed, while he spoke on what machinery had done, and was doing, as well as was to do for the farmer. His eye brightened, his voice grew mellow, and he seemed quite another man. I felt for the time that he had mistaken his calling; he was born to be an orator. I wish I could repeat with a tithe of the force what he said of machinery. In comparison, he pointed out the sharp stick with which the primitive husbandman tried to stir the soil, then the better device seen in the clumsy tree crotch, which the oriental farmer dragged over his field by using his single ox, then took up the true plows, the primitive one with its wooden frame and iron point, then such a one as is kept as a memento of the handwork of Daniel Webster, a plow with beam and board, and handles twelve feet in length, then the cast iron plows, then later the gang and sulky plows. My friend would not commit himself as to the value of steam plows, though he looked forward to their success on broad prairie fields, where a long furrow and an even surface made the use of such machinery possible.

I had to tell my friend of the Saxon plows as well as the Saxon teams; the plows not unlike Daniel Webster's; the teams of strange relationship. Though two horses and two oxen were drawing two plows around the same land, the arrangement was the harnessing of a horse with an ox, and again a horse and an ox. If he had asked me the utility of this queer spanning, I fear I could not have answered satisfactorily; I simply stated the fact.

After the plows, large and small, had been discussed, there came under review the harrows, the patented and the unpatented, from the brush harrow to the more elaborate and effective. Then followed the different methods of seeding—from that of the hand to the broadcast and pipe drills; and I learned which to use under the various conditions of field and soil.

I was not surprised when my farmer warmed in praise of mowers and reapers, and especially of American reapers, recounting the trials they had made abroad, and how they triumphed over all competitors. He gave McCormick and others due honor, and in this I joined him. But when he claimed all credit for the invention of reaping machines for Americans, I was sure he tripped, and told him he was not speaking according to the record. He tersely assured me he was right. I was as confident he was wrong, and searching among the things that had grown cobwebby in my brain, I told him I was sure an old Roman away back had written of reaping machines. He still doubted my statement, and challenged me to produce the record. I could not then and there, but afterwards, after some search, there came out clearly what at that time was dimly floating in my mind. And here is the quotation I sent him, which may, perhaps, interest you as well.

Let me recall the fact that Pliny wrote his Natural History in the first century of the Christian era, and from this work, book eighteen, chapter thirty, I transcribe:

"As to the manner of cutting down or reaping corn, there are various devices. In France, where the fields are large, they set a horse or an ass behind a great wheelbarrow or cart, built like a van, the same set with keen and trenchant teeth, sticking out on both sides. This cart is driven forward before the beast, upon two wheels, into the standing corn, (contrary to other carts that are drawn after), and the teeth or tines fastened to the sides of the wheelbarrow or cart catch hold of the ears of corn and cut them off, the ears falling directly into the body of the wheelbarrow."

"In some places it is the fashion to cut the straw in the middle with a hook or sickle."

"In other countries they pluck up the standing corn by the root."

"In France also they have still another way to gather millet especially; this is, to cut the same ear by ear, upon a comb with a handle to it, as barbers clip men's heads."

More than three hundred years after, a machine, similar to that described by Pliny, is noticed by another writer, and we may suppose this style of reaper was in operation all this time. So it is established that the problem which Bell, Harsy, McCormick and others were working at in the first half of this century, had hundreds of years before been successfully solved in France.

For our comfort, we may say that this centuries' old French reaper was the germ only of what, in the later days, has developed into a universally servicable machine.

In the matter of cutting the wheat, there seems little chance to reduce the present manual labor; the sheaves must be pitched up upon the load and then pitched upon the mow and mowed away. Where the grain is well cured in the field part of the work, that of mowing away may be avoided by throwing the bundles upon the apron of a threshing machine, and threshing as rapidly as drawn from the field.

I recalled for my friend, and repeat for you, a view I once had of harvesting in Saxony. The wheat was mown down by women, bound by women and drawn in by women. I had a simple look at the team,

but the glance impressed the picture permanently. This team was a dun-colored cow, harnessed in with an old white mare, hitched before a wagon with its hay rack, and managed by two women.

I interpreted the story thus: The young men that should have been on the farm had been conscripted and were serving their time in the army, the young strong horses, too, had gone to the army to serve the cavalry-men, and at last the oxen had been fattened for the food of the same army.

We will stop here just long enough to drop some sharp exclamations and hot anathemas over the cause of a standing army; taking as it does the precious lives from the homes, and the best of good things from the fields of a country; blighting the land with burdens and taxes. We will in an undertone, but with deepest feeling of heart, say, *happy America.* Happy country where the bone and brawn and sinew of the country is doing the legitimate work of the country, not wasting itself under a helmet, nor bearing up arms to threaten a peaceful neighbor. Happy the country so entrenched in the love of its citizens that foes from within or without dare not attack it.

Leaving these considerations and going back to the barn where the wheat is stored in the mow, we can follow the process which brings our loaf nearer the oven. The threshing machine, with its fanning mill attached, will make the grain ready for the sack, though a second fanning will better prepare it for the miller. Just how the miller should treat the wheat while in his care, we did not fully decide, whether it should be crushed between rollers and sifted or should be ground between stones and bolted. But this we did decide for ourselves, that for the best kind of bread, preparatory to our toast, it was essential that the bran and coarser particles should be sifted out, that the loss to the flour by separation of the bran is popularly greatly overestimated, that the advantage of leaving the bran with the fine flour is rather mechanical than from any sustaining power, that the presence of the bran is not unfrequently a source of disturbance, that the best way to eat wheat is to use it as fine flour or in broken grains, like oat meal gists. We were pretty emphatic in our views on these points, but concluded to let every one have his own way.

When we came to the matter of leavening the bread, after some discussions of the various methods, we decided—as I think all who hear me will—that while milk risings give good results, still baker's yeast is the best material. We talked over the character of the yeast plant, which, living on the sugar in the dough, produces from this sugar both alcohol and carbon dioxide, the latter of which, in its attempts to escape, converted the solid dough into the plastic sponge. This little tropical plant does wonders in its growth. The old time leaven we thought to be simply sour dough, undergoing slow fermentation, giving to the dough in which it was hid not a sweet but a sour taste. We congratulated ourselves over the thought that in the baker's yeast and in the domestic yeast cake we have a material superior to anything that the ancients possessed, and for which the bread winners and the bread eaters of this generation ought to be appropriately thankful.

But here I must confess my humiliation, when, turning again to Pliny, that treasure-house of things both wise and unwise, to read that in his day the people had a leaven which was essentially the same as ours. I am coming more fully to appreciate the thoughts expressed by Wendell Phillips in his lecture on the "Lost Arts," in which he asserts *there is nothing new.* Farmers' wives who would like a recipe for making yeast cakes can have one here which is nearly two thousand years old. Remembering that fermenting wine has the same little plant that grows in yeast, we are ready to hear about the ancient leaven.

Thus the record runs:

"The meal of millet is singularly good for leaven, if incorporated and worked in with new wine, so prepared it will keep a whole year. Another kind is made of fine bran of wheat, and kneaded in new white wine, three days old, and dried in the sun. Hereof is made a dough or paste, and then shaped into round cakes or troches, to serve for making bread. These must be soaked and dissolved in warm water, which is mingled with the dough and which is thought to be the best way of making bread." (Free translation.)

Then follow directions for making other kinds of leaven, and farther on the names of various kinds of bread. We are reminded of biscuits and rolls as we read: "There are some countries in which the people knead their dough with milk and eggs, and others put butter thereto." We will accept the conclusion of Pliny, in which he says "the best bread is of the finest wheat flour, which has passed through a fine bolt."

We must turn to things of to-day, and dismissing the old Roman from our presence, he is gone. But, ah! our wits come to us too late. Why didn't we ask him before he went away to set out his table and permit us to sample his biscuit and rolls, to break with him the dainty wheaten loaf! Is it too late? We may even call, "Pliny, Pliny, come back; do let us taste of the good things you have told us about." Ah! he is too far away; he is gone; he will not hear us and return.

As we almost hear his footsteps in the distance, we have to return to our own thought and humiliation, that in leavening our bread and making our biscuit we stand scarcely ahead of the ancients.

Still busy with our toast, we inquired why the browned slice was more appetizing than the well ripened loaf. This was the conclusion: That the starch of the flour was still starch in the well cooked baked loaf, but in the slice, the greater heat of toasting it, was changed to something else, a new substance which was more soluable, more easily digestible, and at the same time had a pleasanter taste.

So much for the bread of which our toast was made. Turning from that, we took up the butter which made the toasted slice so palatable. We hardly knew whether that before us had had sugar added to it; we decided that the golden color, rendering it so inviting to the eye, was not wholly due to the original color of the cream, that some coloring matter, domestic or purchased, had been added. But to the palate this coloring matter gave no sign. We learned, incidentally, that the dairy from which this butter came yielded an average of three hundred pounds to the cow.

My friend said that all the hard work on his premises in preparing the winter food for the cows was in pitching the hay from the load in haying, and mowing away, and further, that before another year was over he would have an arrangement by which even this hard work would be unnecessary. I inquired how this would be. He said that the hay crop might be secured almost wholly by machinery, driven by horse power. His directions for getting hay were: Cut with the mower in the morning, follow soon with the tedder, stirring perhaps twice, or more if necessary, then put to the horse-rake, raking carefully, and then gather upon the wagon by means of a hay-loader, and the load is ready for the barn. In the barn comes the tug of pitching off and mowing away. And this hard work is unnecessary, my friend said, if the barn is only right. He had seen a barn that pleased him, and he was preparing to build one on the same general plan. For any of you farmers, who are about to build a barn, I give the plan. The barn is to be built in front of a little elevation or hill, and will have two barn floors, the upper of which will be high up and on a level with a road that runs along near the top of the hill, with which road it will be connected by a wharf or bridge. From this road over the bridge, into the barn, just under the roof at the gable end, the load will go. Now all the bays will be lower than the floor, and instead of pitching up from the wagon rack, it will be pitching off, and the work of unloading will, in homely phrase, "be as easy as rolling off a log." There will be a turnstyle or broad place on the barn floor so that the wagon may be cramped around and drawn out by the team. This seems perfectly feasible, so that with proper machinery and properly arranged barns the hard work of haying may be counted with the things of the past.

While commenting on the uncertainties of the weather during haying and harvest, a matter that perplexes every farmer, my farmer made some suggestions, which I did not heed very much at the time, but, as I have thought them over, they have grown upon me, and I will repeat them, that we may have your judgment on them.

Speaking of the weather probabilities, as published by the United States Signal Service, he said the facts on which these prognostications were based were gathered from a great range of country, and, too, at great pains, and were in the main fulfilled. He thought as many as eighty-seven per centum of these forecasts proved true. He would not, however, be certain as to the percentage. He asked, why may not such valuable information be at the command of every farmer through the season of haying? And I repeat, why not? With a very little thought and expense all may know the weather probabilities of the day.

The plan in brief is this: Let signal stations be established in each town, from which, during the months of July and August, and later if desired, signs previously agreed upon, shall be telegraphed through the country, these signs being the intelligence in regard to the weather obtained from the wires of a near-by telegraphic station. The signal station or apparatus therefor would be a high flag staff, signals, and

ropes for running up the signals. For signals have flags; white, indicating fair weather; white bordered with red, slight showers; white barred with red, showers prevail; red, when the day promises settled rain. Other flags indicating clearing weather may be used when the rain has fallen. These stations, of course, should be on high eminences.

As an illustration of the working: At, say half-past five, 5.30 in in the morning, a white flag is run up from our passenger station, or from the cupola of the Addison House; the observer on Chipman Hill on the alert catches a glance of the rising white flag; and his white flag is at the top of the staff almost as soon as the one at the station; the observer from his lookout on Snake Mountain with his glass catches the signal from Chipman Hill, and he at once sends up his white flag, and then on hill top, and hill top; from town to town, the signal goes up, and in less time than it takes me to speak of it, thousands watching, know the token and promise of a fair day.

This, as you will see, with a slight modification, is but a revival of the old signal method, once used by the Scottish clans.

Next, while waiting for a change of plates, we ran on in our undertone about some of our humble and despised friends. We had the past few months been learning more about the animals that delving or tunneling in the soil have made it rich with the digested or buried vegetation. We had learned that the earth worm is good for something besides food for robins and bait for fishes. Much, very much, it has done in preparing the soil of our fields, giving them a fertility which otherwise they could not have had. And now it is found that the mole is one of our good friends. In the northern valleys where from the cold the angle worms fail to mingle the vegetable growth of the surface with the hard subsoil beneath, the moles take up the work, and they with their burrowing kindred work over the upper and under soil, until thousands of square miles of hard clay lands become fertile fields; until all the valley of the Red river of the North becomes the wheat lands of America. And now upon the table came the buckwheat cakes, and our discussion took a political or semi-political drift. We each had opinions of our own, but these I shall not rehearse here. The briefest statement of the conclusions we reached, I submit to you for your approval or disapproval.

First, in regard to the relation of the State government to the agriculturist, the farmer has a right, from the funds within possession of the State to expect, (1) that the best education possible should be given to the children of the State; (2) that his lands and property should be protected from trespass; trespass from cattle, from dogs, and from men; his fields, his flocks, his streams, and his forests, should be secured to him without any breaking in or going out; (3) that he should be protected from fraud in the purchase of goods, especially in the purchase of fertilizers; (4) that he should be encouraged to plant forests, and drain swamp lands; and such improved lands should for a term of years be free from taxation; (5) that the water courses of the State should be protected from becoming dry, by protecting our mountains from being stripped of their timber.

The State by purchase or renting should obtain control of the mountain crests, and so keep them from being deforested. I wish you to approve this last thought if it commends itself to your judgment.

The conclusion we reached in reference to the duty of the general government towards the farmer *we* thought sound, though *you* may hesitate to approve them. We started off with a sort of preface, or something like a *whereas*, introducing a set of resolutions, thus: The great industry of the country is agriculture. Thousands of millions of treasure are annually produced from the soil. Our prosperity as a people is most largely dependent on the prosperity of this department of labor.

Our general government may fit out expeditions for scientific purposes; it may send men to view a transit of Venus; it may send other men to observe an eclipse of the sun; it may learn, if it can, whether there is an open polar sea; it may even expend millions on improvements of rivers and harbors, and we will not very loudly complain. But if it refuses to foster the first great industry of the country, every farmer should lift up his voice.

Nothing less than a complete organization of a department of government equal to the highest departments now existing should be accepted by the farming population. The best interest of the country should be called to fill the secretaryship of the department of agriculture. *Your* minds will naturally turn to such a man as you have listened to here in our own village, and by whom you have been delightfully instructed: Professor Brewer of Yale College. The man whoever he may be should be above politics in its low sense, should rise to the height of a statesman.

You will perhaps ask, what such a man, empowered by government could do for the agricultural interests of the country. Let us think what the Secretary of Agriculture, together with the men he would call around him, could do.

We, as we talked, decided that there was in our government a large place for such a man to fill.

(1.) He could care for and strengthen every legitimate pursuit of the farmer already established.

(*a*.) He should be fully empowered to see that our products offered for sale are just what they purport to be; should have power to inspect articles of food offered for sale, both that which is to be transported abroad, and that to be consumed at home; and by opposing or condemning such articles, prevent any shade of suspicion or falsification from falling upon any American product. Falsified goods he should have power to confiscate, and power as well to condemn and imprison the offender.

(*b*.) He should have large power to control the public domain, and take care that it be parcelled out into farms for legitimate purposes, not for speculation by railroad companies or syndicates, but for actual use.

(*c*.) He should have power to make large outlay of money in experiment to increase the amount of arable domain, and to determine

whether places now given over to waste and barrenness may not be made farming lands by systematic irrigation.

(*d.*) Government, and government alone, we insisted, was competent to carry out, through a long period of years, certain researches, which, if settled in our favor, would be of untold value to the population of the United States.

(*d′.*) The first I will mention is the introduction of new industries. We can and we ought to raise our own sugar. The experiments begun as to the capability of sorghum, or cornstalks, to furnish our supply should be completed. We have a right to know whether these can furnish us with our sweets. I will not repeat the emphatic words which my farmer friend used in regard to the present ornamental head of our agricultural department as we spoke together about the cutting short of the unfinished experiments of sugar production from these sources. These words are perhaps only an echo of your own thoughts.

(*d″.*) Trial should be made of raising fruits, spices and condiments now imported. We ought to raise plants for tanning our leather, instead of cutting our hemlock and oak timber for this purpose. We ought to raise a plant containing so much available woody fibre that it may be used for paper, and so save our poplar and spruce from the pulp mills. New industries such as here indicated would be of great importance, and the Secretary of Agriculture should have power to attempt their introduction.

(*c.*) Another series of researches have these years been calling loudly for completion. Here emphatically government must come in. Year after year untold losses are inflicted on the farming community from insects and disease. Leaving out of consideration just now the depredation of insects and parasitic plants on our vegetation, let us think of the plagues that fall upon our animals.

The lung plague among cattle has in other countries destroyed thousands of stock, at the loss of millions of dollars. In our own country it has done great damage. Too, our country has suffered vastly from the swine plague. Millions and millions of property have from this cause been completely lost.

The Secretary of the Department of Agriculture ought to be directed by the farmers of the United States to give himself no rest until the cause of these troubles is known, and the remedy is completely known. He may take years of time and millions of money, if necessary, but he must not stop short in his experiments and researches.

Other and weighty matters in regard to the relation of the government to agriculture we discussed, and, so well as we could, settled. But our toast was eaten, our buckwheat cakes had disappeared, and, indeed, our breakfast was done! And I, I am done.

"REVIEW OF MODERN DAIRY METHODS."

By A. D. Evarts of Waltham.

It was with much apprehension that I consented to read a paper before this convention of intelligent farmers and dairymen. It has been my purpose always to avoid expressing in public any decided opinion on the merits of this or that method—the question of deep or shallow setting, of medium or cold temperature, etc.,—but to allow the interested parties to show up as best they could their pet theories and machines; they have usually been very willing and very capable of doing it. Out of much discussion has come a clearer light, and to-day no dairyman has an excuse for not knowing every detail of his business. Of the various breeds of dairy cattle I shall have but little to say. The general purpose cow has not as yet proved a success; it is contrary to the spirit of the times. Specialties rule the day, and are a success in proportion as they are intense.

The purpose of this paper is not to urge the adoption of special methods, but is intended as a review of the practices of those who are making a success of their business. The possibilities of the *dairy* interest in the future is practically unlimited and opens up a field of investigation and work well worthy of the highest ambition.

In all the mechanical arts a good machine is indispensable to the economical production of good work, and the first cost and value of this machine is based on the amount and quality of its work.

The cow is but a machine, and her value should be based on the amount of raw material she can convert into the best quality of salable goods with the least possible waste.

The difference in value between a good and poor cow is not appreciated as it should be. It is often the case that in cows of the same beef value a difference of twenty dollars is made in view of her dairy qualities, when two hundred dollars would be nearer the mark. The value of a *plant*, as an investment, is dependent on the per cent. of income. To illustrate, we will take an average, not an extreme, case. Two cows are purchased, one at forty dollars, the other at fifty dollars. The first, with twenty-five dollars' worth of care and feed, yields forty dollars—fifteen dollars net cash, thirty-seven per cent. on the investment. The other, with a little better care and feed, say thirty dollars' worth, yields sixty dollars—thirty dollars net cash, sixty per cent. on the investment. Now the actual cash value of this cow is eighty dollars, based on the per cent. of income.

Two forty dollar cows occupy just twice as much room, have to be fed, watered and milked just twice as much as the eighty dollar cow, still it means thirty-seven per cent. in both cases. Through neglect

to test each cow of the herd, and it is a very simple matter, we are liable to be milking twice as many cows as we need to for the income received.

There is no remedy save in this test. No points on which *absolute* dependence can be placed. We are of course often called upon to judge of a cow by a scale of points in purchasing, but there is no excuse for keeping her a term of years without knowing her value.

I do wish this point could be fully appreciated, and that in general practice cows might be priced, bought and sold at their actual intrinsic or test value as milk producers and butter yielders, and thus put a premium on excellence and an inducement to breed up superior stock for sale as well as for home use.

Our most successful dairymen are breeding for rich milk ; fair quantities of rich milk, rather than a large flow of milk. Cows yielding from twenty to thirty pounds of milk a day are found to give as much within the year as those giving forty to fifty pounds per day, by reason of their holding through a longer milking season. A rich milk, therefore, becomes a consideration.

The number of pounds of milk required for a pound of butter, on the average of this country, is from twenty-six to twenty-eight pounds, with the native breeds of cows ; whereas we find carefully selected herds giving a pound of butter from fifteen to eighteen pounds of milk, and individual cows going as low as ten and even nine pounds ; quite a difference when we realize that these cows will give nearly as much milk in the year as the thin milkers. Having selected the herd, the next step is the feed and care.

The machinist who has a good machine does not expect to turn out superior work without the best of raw material judiciously fed. He knows this machine must be well set and carefully tended. This holds wonderfully true in the care and feed of dairy stock ; warm, well ventilated stables, pure water—free from ice in winter, and foulness in summer—early cut and well cured hay, a good assortment of meals and a liberal supply of the same.

Variety of feed is essential to a full flow of milk. Corn meal as a staple, barley and oats, with, or in its place, shorts, bran or middlings, at the present a cheap feed ; and as a most economical and profitable food in a small way, cotton-seed and linseed meal—worth their cost as a fertilizer. Clover is one of the best grasses you can give a milch cow, and it is also a sure crop, if cared for ; changing the character of our heavy clay soils as nothing else will, and making it possible to raise our own wheat. The alsike, being perennial, has staying qualities beyond the common kinds, which will of course recommend it, and it is better adapted to moist soils, thriving where other kinds are sure to winter-kill. Orchard grass is a favorite with those who have given it a fair trial.

Ensilage seems to be gaining ground and has evidently come to stay. The extravagant statements of enthusiasts, who, for the first time in their lives, found that corn stalks *were worth something*, has in the end been a benefit in teaching their value, whether in or out of the silo. It is found that white southern or western corn, sown in drills,

about two bushels to the acre, on well manured land, will give an immense amount of valuable fodder, and that it can be cut and cured in the field, about wooden horses or in the fence corners; left there until wanted, even into or through the winter, and that when wanted drawn in and run through a proper feed cutter will all be greedily consumed, with the best of results. Many think this more economical than the silo.

A practice of having a part or all of the *dairy* come to milk in the fall and early winter is to be commended to a certain extent. It is past question that more net profit may be got by this method when intelligently managed. A longer milking season is maintained and a better average price. As a rule cows are better kept, fed and cared for, and come out in better condition in the spring. It is found possible to make as good butter in the winter as at any time by neatness and care.

The various patents and devices for creaming milk may all have their good points, and their agents are left to prove them to you. I will only allude to one or two of the latest ones, which are now exciting great attention.

The delicate character of cream and the facility with which it absorbs impurities and hastens to decay makes time a vital factor in its manipulation. This has long been a recognized fact, and while our inventors were trying to force this separation and shorten the time by cold setting in the inventions of Cooley and others, the experimenters of Europe hit upon a mechanical method to accomplish this end. Cream being lighter than skim milk, centrifugal force would cause the heavier particles to seek the circumference while the lighter cream will gather at the centre. This fact once being recognized, modern inventive genius soon conquered the mechanical difficulties of the problem, and to-day we have the perfected centrifugal cream separater, a thoroughly practical machine, adapted alike to the large creamery and the moderate sized dairy, large ones of a capacity of fifteen hundred pounds of milk per hour, and the little fellow that you can cover with a flour barrel, and run with a one-horse power. This looks like a revolution and a revelation in the possibility of the dairy's future.

Last fall I saw at Brigam's milk depot in Boston two of the large separators—the Danish Weston. They were each turning off continuous streams of cream and skim-milk into their respective receptacles at a rapid rate. The milk used was brought from the country by the car load, and was often in sad condition. I saw it one hot morning very sour, but the cream had to come all the same.

I understand that this winter they are sending this cream to the hotels south as far as Florida. The wonderful purity and sweetness of this cream is creating a demand which bids fair to assume large proportions and increase the consumption of dairy goods.

The "DeLavel," invented in Sweden, is a wonder of simplicity and beauty, and its price will bring it within the reach of a moderate sized dairy. A light, strong steel bowl of one foot in diameter, the top or neck drawn in to about five inches, is set in an upright spindle

in flexible bearings, and is spun around like a top, at the lively speed of from seven to eight thousand revolutions per minute. A continuous stream of warm milk falls directly in the centre of the bowl, and is instantly thrown to the outside. The pressure is so intense that an immediate separation takes place. The cream collecting on the inside of the wall of milk rises around the neck of the bowl, and is thrown off in a smooth liquid stream, thick or thin, as desired. The skim milk is taken off in a similar way by means of a bent tube, collecting it from the back of the bowl, carrying it up the neck, and throwing it off into its own receptacle.

It is said to be perfectly practical to set these little machines in the barn where the milking is done, and run them with the common tread power. When the milking commences put in the horse and start up; by the time you are through milking the cream is all out of the milk. You can feed the warm skim milk to the calves and hogs, carry the cream off to the honse, and the work of the dairy is done for the day. From ten to fifteen per cent. more butter is to be had from the milk than by any other known method. Beside it is the best milk-strainer to be had. All impurities, sediment and dirt, by reason of its weight has to take the outside seat, and is found on the circumference of the bowl when the day's job is done. There are said to be eighteen hundred of these at work, although their invention is so recent. The Western creameries are fast putting them in.

But the end is not yet. Vermont again comes to the front in the person of Powell of Burlington, and we have what is known as the vacuum process. A practical milk laboratory in which each element or constituent is made to reveal itself, and take its place on the table and in the medicine chest. I am not sufficiently familiar with this process to describe it. The claims are these: That by the application of heat in a vacuum all impurities are drawn off, and then by a rapid cooling to forty degrees, the cream is forced up and the milk drawn from under. The cream is churned, the buttermilk returned, and the whole made into cheese, which by reason of said processes is as good as whole milk cheese, as it now contains a newly created or developed substance, named albumen. The whey has now been so thoroughly relieved of its burden of butter, caseine and albumen, as to readily yield up its sugar by evaporation, or left to itself makes a superior vinegar.

Here is a table of the value of one hundred pounds of milk treated as above:

5 lbs of butter at 40 cents	$2 00
9 lbs of cheese at 13 "	1 17
5 lbs of sugar at 35 "	1 75
Total	$4 82

Or should the milk sugar, now used to triturate homeopathic doses by reason of over production, become a double drug on the market, ten gallons of nice vinegar may be had in place of the five pounds of sugar, which will reduce the grand total somewhat, yet leaves a fine margin of profit. It is time, indeed, we were looking after our waste

products, particularly when such results as the above are *guaranteed.* The care of the cream is considered one of the most important items in the manufacture of butter. To churn it sweet is a sure loss in quantity, and its keeping qualities, for some reason, are not as good. Why, I cannot tell. To ripen it then to a proper sourness or degree of acidity, is the lesson we must learn and *always observe.* When taken from the cold setting it should be warmed at once to seventy degrees, and then allowed to stand in a temperature of from fifty to sixty degrees, when it will usually ripen in twenty-four hours. When it is desirable to hasten this ripening, a little cream may be kept out from the last churning. Some, however, question this practice, but in very cold weather it is often necessary, as the churning will be so long delayed that bitter butter will result.

Too many of the hand grist-mill churns are yet found about the country, but are rarely tolerated in a well conducted dairy, and are never found where the best butter is made. Only the revolving box or barrel, and occasionally that apology for the same, the oscillating, are safe where a fine grained and good keeping butter is expected. With these churns and a thermometer, one may be sure of his butter coming in the granular shape every time, and be sure of keeping it in this shape until thoroughly washed and ready for the worker. The grain of the butter is badly damaged by the practice of twice working, that is, letting the butter stand a few hours, and working a second time before packing. But this is fast going out of date, as a damaging and useless practice.

Much is said just now against the cold methods of setting milk, as damaging and prejudicial to the keeping qualities of butter, through chilling and sudden changes of temperature. This cry is not wholly without rhyme and reason, although (from the source whence it came) I am inclined to believe it was started in the interest of some patent arrangement. Yet we know that ice in contact with either cream or butter is a bad thing, injuring it at once and noticeably, and why should it not injure, in a less degree, when used in or about milk. This is a point we would like to have the old heads discuss. It is an extremely fine point, and applies only where the competition is brisk up among the fancy grades.

The future of the dairy interest is assuredly growing brighter. The demand for fine butter and cream, at remunerative rates, is always ahead of the supply, while the cost of production is lessened by improved methods and skillful breeding and selection of the herd. It makes a wonderful difference in the cost of a pound of butter whether it takes ten cows, or twenty, to produce three thousand pounds of butter in the year. Now, when you get home just figure on this a little. There are dairies of thirty cows and over in this county which average their three hundred pounds each, but there are more by far which will not reach the average of one hundred and fifty pounds. I am constrained to believe that if the practice of keeping accurate accounts of the yield of your herds should become more general, a marked improvement would result. Now I am an earnest champion of the Jersey, but am not here to-day to ring her praises ; she is abundantly

able to gain and maintain her place. I only ask that you give her claims as a wonderful little butter cow your critical and careful consideration. It is *too much* to expect beef and butter from the same animal. I should as soon expect good pine saw-logs out of an apple tree. The Holstein has many friends and is a big producer of milk, and as a cheese cow has few equals. The Ayrshire, also, is good in her place. But where butter is the end in view we can't afiord to slight the Jersey and her grades.

In conclusion, let me urge the necessity of closer attention to the minor details. No reading, thinking dairyman need be told *what* these details are. They are reiterated again and again in our associations and agricultural publications, and no man who has a proper interest in his business but that is posted, or has no excuse for not being posted. What we need is a waking up, a questioning among ourselves, to ourselves and of ourselves. Why are we content with thirty-five dollars and forty dollars per cow, while a neighbor gets his sixty dollars and eighty dollars? Why are we selling our butter at twenty cents, while a neighbor gets his thirty-six cents and forty cents? Why are we keeping twenty cows to do the work of ten? Why are we using scrub bulls, regardless of blood or record? Why staying at home theorizing. saying this can't be done, that can't be done, instead of getting about and seeing what is done? Why am I saying, "Old red is the best cow in the herd; little Fawn the poorest?" Why is neighbor B—— buying shorts, bran and cotton-seed, while I have grain to sell? What does he do with it? Can he make it pay, feeding it to his cows, and all he can raise beside? Can there be a profit in it? Can this have anything to do with his improved and constantly improving farm? Do these things concern me? you? Is there not a mistake somewhere? Can it be with me? Am I honest with myself?

Gentlemen, is not here a point? Farmers, be honest wlth yourselves. You can *least* afford to deceive yourself in these matters. When you make a move, know why; why you sell this cow; why you keep that one; why you have adopted this method or that system, or why none at all. Consider these points, and consider them well.

"EASTERN AND WESTERN FARMING."

Read before the Institute at Middlebury, by LYMAN W. PEET of Cornwall, Vt.

Much has been written of late years in reference to the far west. A vast area of territory lying beyond the confines of civilization has, during the last twenty years, been wrested from the savages; and the progressive spirit of the age has been shown by constructing highways across the entire continent. Thus access to our western frontier is rendered easy, and the prairie is no longer the land of mystery, traversed only by the hunter, or celebrated in song; but sturdy farmers are trudging along with their teams, turning over the virgin sod as a seed bed for future crops, with which to feed the millions. Very naturally a western boom was created. "Go west, young man," was the advice of the hour, and was so far heeded that much of our best muscle and nerve was transported to our western frontier, with hopes of accumulating large fortunes. Some of these hopes have indeed been realized; but the same sacrifice and perseverence exercised upon these rugged Vermont farms would likewise have worked wonders.

Having spent some years in Kansas, Nebraska, Wisconsin and other western States, not as a spectator simply, but as a "tiller of the soil," I desire to present a few observations relating to the east and west as suggested by personal experience.

The wonderful productiveness of the western prairies as compared with our long-cropped farms comes first into prominence. The alluvial deposit of from one to many feet deep over a vast area in the west, is very inviting to the farmer's eyes; for he knows well that every seed that he drops into the soil is happily at home there, and will shoot up with wonderful vigor. I have myself seen corn peeping through the black soil four days after planting, and the matured stalks in autumn fifteen feet high. And a purely *western* man will tell you of corn growing twenty feet high; and should you doubt his statement he would quickly add five or ten feet to that! But vegetable growth there is quite remarkable, as all must concede, and this fact is very stimulating to the young farmer. His pulse moves quick like the crops he tends; and not till a severe drouth, a destructive hailstorm, or hordes of devouring locusts have laid waste his entire crops, so full of promise, does he think with respect of the rugged but prosperous little farm he left far away at the east. The poverty and not the richness of our own soil is most frequently discussed; and it may be pertinent to ask, How far, if at all, does the west surpass the east in crop yields per acre? In 1877 the agricultural reports, officially given, enable us to present the following data: The average yield of corn

per acre in Illinois, Iowa, Kansas, Nebraska, Minnesota and Missouri was thirty-two and one-third bushels, while the six New England States averaged thirty-five and one-half bushel, thus surpassing their western sisters over three bushels per acre. The same States compared with reference to wheat—omitting Rhode Island, of which no wheat record was given—New England is still ahead by more than two bushels per acre. In oats, however, we were slightly excelled. In the production of corn per acre, Vermont and New Hampshire were unequalled by any other two States in the Union.

A similar comparison of States from reports three years later shows a difference still greater in favor of New England.

It thus appears, unless statistical returns greatly err in our favor, that New England with her rocks and hills and rugged climate actually produces more of the important cereals year after year, than has been grown on the same area in the garden of the west.

This statement is made, not to prove the greater fertility of our soil over that of the west, but to show what can and has been done, even by our poor and defective methods in farming. The possibilities of our soil are underrated. Think of raising four hundred bushels of potatoes or forty bushels of wheat, or one hundred bushels of shelled corn to the acre. This has been done. Think again of producing ten and three-fourths bushels of oats from two ounces sown. This and similar statements have been reported under oath. Gold is obtainable to-day from eastern farms more cheaply than by digging it from the California mines.

Evidently, there is ample opportunity for a young farmer of talent to display his progressiveness at home, nor need he flee to the west in order to raise large and profitable crops. The man who handles the most money is not always the richest; so he who tills the largest farm is not always the most prosperous. This thought suggests the different methods pursued east and west in all farm enterprises. Nothing small satisfies a western farmer—many acres, many cattle, many horses, many hogs, and many children; with the last two his enterprise seldoms fails! Nor should his methods be severely criticised. His surroundings demand expansion. No where else in the civilized world are the great staple products of the soil so cheap as at the west. To produce large profits, large amounts must be raised. This is attended with a greater increase of physical than of intellectual exercise. Agricultural machinery is utilized to the utmost; but this intensifies, if possible, the serfdom of labor. Every new machine means more acres cultivated, and shuts out time for social or intellectual culture. The frontier farmer seldom sees a daily paper. And here the comparison is much in our favor. We study, as well as work. Our soils are varied and require different treatments. We apply fertilizers, rotate our crops, experiment, raise fine stock with a pedigree, hold agricultural meetings and are reasonably happy!

The question is here submitted whether it is not better for a young farmer to care for one hundred acres of land scientifically at the east, and by correct management save three hundred dollars yearly, than to lay by the same from four times as much land at the west, where

they "farm to waste." In the first case the mind and farm are both cultivated and improved; in the latter far less so. It is the "almighty dollar" the emigrant seeks upon our western frontier, not culture, and a low grade of many nationalities is found there; and hence the competition is too much of physical force for material prosperity. This upon the frontier. Improved conditions come with age; but most young men seek the front, where the land is nominal in price, and where the range is unoccupied. Such a locality is not desirable in which to rear a family.

But in behalf of many western practices and the spirit with which they are conducted, much may be said to our disadvantage. Like an overwhelming blizzard their enthusiasm sweeps all obstacles before it. Mountains are turned by them into mole hills, and what they undertake moves on majestically like the Father of waters which sweeps through their vast domain. *Perseverantia omnia vincet* has a meaning to them. Their net-work of railroads, their cities of great magnitude, fed by myriads of thriving villages, their flocks and herds, their grain products, which affect the markets of the civilized world—all these and more attest to a catholic and persevering spirit, as well as to a productive soil. If the west is too wild and progressive, the east is too tame and conservative. Our farmers have a penchant for old ruts and ways which are distasteful to their sons, who often, from impulse and a one-sided picture of the west, flee from homes to "ills they know not of." Few farmers' boys know anything of the serious drawbacks to frontier farming. Let me present a few.

The climate is often compared to that of balmy Italy, and advertised as a panacea for the many ills to which eastern persons are subject; but fresh graves are there, as well as here. Bilious disorders are far more numerous. The ague seldom passes by the new comer, while cholera infantum carries away many a little rose-bud of the family. The health picture is overdrawn. Consumptives and asthmatics are often improved; while of other patients not a few soon sleep with the prairie flowers. The healthy young farmer is quite as sure of a long lease of life here in Vermont as he would be in Nebraska. It has truly been said that the climate of the west is the finest and meanest in the world. Like a fair maiden, roseate and beautiful with the charms of youth, nature, at some seasons of the year, smiles with a bewitching enchantment. The green carpeting of grass bedecked with wild flowers, the rich waving grain, the drumming of the prairie hens and a multitude of such things have a newness and freshness which captivate the senses. The sunsets, also, are beautiful and the air is clear and ambient. I once saw a mirage representing a village located twenty miles away. The view was brief, but the streets and houses were all distinctly seen.

While nature is robed in her best dress and remains uniform, the west is a delightful place in which to live and farm. But there are other scenes there most appalling. The wind, that unseen spirit of the skies, sweeps over the naked prairies with terrific force, even when no cyclone bears upon its wings the message of death. Not one day in the week, but often seven, the ethereal elements are astir with such

vigor that to load hay, or sow grain by hand, would be presumptuous. Wind-breaks, formed by groves artificially set, are helpful in protecting these primitive homes; but on the open prairies—and little other land is now subject to homesteading—the wind has free play, and renders all labor a hardship, while life itself is often imperilled. Let the eastern farmer, therefore, remember that our rugged hills and mountains were not made in vain, but stand as substantial bulwarks to check the wind and to contribute in many other ways to the comfort of man. Again, nature at the west delights in extremes. One year fortune smiles, and the land "floweth with milk and honey," and truly it is a "goodly land." Anon, fortune frowns, and "it is a land that eateth up the inhabitants thereof." There are grasshopper years, when the skies are literally dark with these devouring pests. Alas, for the Egyptians if they were so afflicted! The farmer is a helpless and agonizing spectator. His accumulated profits for the season are swept away in a single night, when the happy locusts move on to new fields of conquest. There are years of drouth, when for a season the Great American Desert becomes a sad reality; years of floods, also, when the "waters prevail exceedingly upon the earth?"

Is this a fancy sketch? It is too real. Not alone has "bleeding Kansas" appealed to the east for material aid. Nebraska, Minnesota, Dakota and other sections, visited by some of these dire calamities, have raised a cry of distress, and a generous response has always been accorded by philantrophic New England.

Land speculators and railroad companies do not advertise these drawbacks to frontier farming; but they are realities, and the farmer who chafes in his home-harness, and sighs for a change to the westward, does well to view the picture in all its lights and shades.

But the sunshine of prosperity does not always gild the hills of New England. True. Some hardships are even imposed upon us by a contrast with the west. Our cultivated fields are too small; our fences too numerous and expensive; our plows are obstructed by rocks; our soil must be fertilized, while thistles ever delight to blossom in our face. It would be blindness, also, to ignore the fact that the increasing products of the west steadily tend to curtail our profits. Only by the use of greater skill and capital, by which production shall be cheapened with a quality so superior as to command the highest price in the market, can we hope successfully to meet western competition. We must produce gilt-edged butter or none. And our wisdom should be manifested in assisting nature to do her best. The gardener, the florist and like specialists do this, and show us what vast profits can be realized from small areas of land. Fertilization, *in an economical way*, as urged often and wisely by our worthy Secretary, is the first step in advanced farming at the east. Ascertain by experiment the needed element in the soil; apply that, and only that; this done, and the problem of success is half solved.

This is a large country, and there are sections where specialties may be pursued with profit. Maine furnishes a vast amount of lumber; tar comes from North Carolina; oranges from Florida. Maryland provides us with canned fruit, and Vermont glories in raising fine

Spanish Merino sheep. Our own little state would be a long time in getting rich by raising oranges; and Florida would fare little better in rearing our fine sheep. There ought to be in farming, east or west, a perfect adaptation to natural and artificial surroundings. Vermont's supremacy in the production of fine sheep is unquestioned, and the profits of the business satisfactory. What matters it to us if wool raising simply is unremunerative here, provided we make more by furnishing stock sheep for the west? Both sections of the country are profited thereby, while we enjoy cultivated or skilled labor—always desirable—in the breeding of fine stock animals.

But the demand for superior cattle and horses is scarcely second to that of sheep, and the opportunity should not longer remain unimproved. Our small farms, superior buildings, good water and feed, together with our greater patience in attending to details, should enable us to furnish these stock animals of improved merit.

The western dairyman should find his butter cow here in New England, not in the Isle of Jersey. Boston and New York would absorb any surplus stock, while our own dairies could be kept up to the highest point of excellence. By thus breeding the best animals of the east will always find a ready and remunerative market, and the business will add alike to our intelligence and to our material prosperity.

By observing the law of adaptation, the east and west, as also the north and south, shall prove of mutual helpfulness by increasing the strength and unity of our common country.

SOME CONSIDERATIONS ON THE GERMAN FODDER RATIONS.

By Loren P. Smith of Trumansburgh, N. Y.

The first and last duty, necessity, instinct of every animal is to live; as it protects itself from all outside dangers, and takes advantage of every favorable circumstance to this end, so nature does the same with the food taken into the system. The processes of life must be sustained first and at all hazards. If we supply just enough food for this we keep the animal standing still, neither gaining nor losing; this constitutes what is called a "ration of maintenance." The amount necessary for a ration of maintenance increases from the day of birth. Mr. E. W. Stewart, of Western New York, says that the food of support represents fifty-five to sixty-six per cent. of a *full* ration, generally taken at two-thirds of a full ration. With a steer four years old the food of support for the second two years would be probably quite equal to the entire food eaten by the steer for the first two years. This was proven by the prizes at the last Chicago Fat Stock Show in the class on "Cost Production."

"In the three year-old class first prize steer weighed 2,445 lbs., and cost $214.53, or 8$\frac{77}{100}$ cents per pound. In the two year-old class first prize heifer weighed 1,135 lbs., cost $58.18, or 5$\frac{12}{100}$ cents per pound. In the one year-old class first prize weighed 1,160 lbs., cost $47.11, or 4$\frac{61}{100}$ cents per pound; second prize to steer weighing 1,105 lbs., cost $44.43, or 4$\frac{1}{4}$ cents per pound." It will be seen that a pound of beef in the three years-old costs more than double what it did in the one year old.

This two-thirds of the ration required for support will be taken by nature at the sacrifice of everything else; the animal will cease growing or giving milk, or taking on fat. After this point has been gained, after the food of support has been supplied, what food remains over goes to produce growth or milk or fat,—in other words, it goes to profit, and *all* the profit comes from the last one-third of the ration. If we scrimp here we add to our expenses at the same time that we cut off our income,—a rather expensive proceeding. It costs money to feed stock; the only return is in the manure, unless we make a gain in weight or in milk. We forget these facts when we keep an animal till he is three or four years old before fattening, or when we are feeding an insufficient ration of perhaps poor fodder, to save it. (Heaven save the mark!)

If the profit comes from this last one-third of the full ration, we ought to know what constitutes this last one-third; and we should understand, too, whether the difference is simply in amount, or

whether it is in the kind of food, or in both. Will any kind of feed pay us? Are we sure of gain if we give the animal all it wants to eat? Does it make any difference how we combine these different feed stuffs? Will it pay me to buy any additional food stuff?

First, let us consider what is the best method of feeding and where we find examples of it in practice? While in Connecticut last winter, a shrewd, old Yankee farmer told me that he had *spent a lifetime* in learning how to feed cows, and had found that the best feed was corn meal and bran, with meadow hay. On a little inquiry we could get a dozen experiences no better than this: it would be a chance if half were as good.

In this country where grain is so cheap, especially corn, and money which they do not owe, among farmers, is so scarce, the rule is where there is a beef to fatten or a milch cow to feed, never to buy anything, but feed what is raised on the place; the result is that corn, plus cornstalks or hay, is almost the exclusive diet of beef and milch animals,—a very defective ration.

No trials worthy of the name have been made in this country to determine any of the questions bearing on this subject. And really it *is* a difficult one; if the cow were a machine simply, we could put in a given amount of food and expect with full assurance certain results. But instead of a machine, she is a living, feeling, animal with a very complex organization, affected for better or worse by the air she breathes, by the change of temperature, by the treatment of her attendants, and the like.

Her well-being depends on so many things aside from food that it is difficult to get uniform results even when the greatest care is exercised; and when such results are obtained we can not always with certainty tell to what they are due,—whether it is all on account of the feed, or whether some unexpected modifying influences have not crept in and changed the result.

Again, no two animals are alike in weight, appetite, power of digestion and assimilation, etc.

To come at anything like exactness in determining the question of the best system of feeding takes a large expenditure of money, and, what is more valuable, of time of educated and skilled experimenters, —too much of both for this young and rushing and "booming" people.

The best work and only good work that has been done in investigating this important subject comes from Germany, and, perhaps, England.

Time and space fail me to speak of the patient labor and painstaking care given to this matter by such men as Wolff and Kuehee, and their large number of worthy coadjutors. Everything the animals took in, in the shape of food and drink, was weighed and analyzed,— even the air they breathed; also the excreta were weighed and analyzed, including the gases given off from their bodies and lungs. One who is ignorant of chemistry or of experimenting can form no conception of the amount of care and labor this involves.

For ease of understanding and applying these results they divided the elements composing the different foodstuffs into four classes; only three are used in calculating the ration:

1st. Protein, or that part of the food containing *nitrogen.*
2d. Carbo-hydrates, such as starch, sugar, glucose, gums, etc.
3d. Fat, nearly the same as animal fat.

The 4th class consists of the *ash*, what remains after burning, and is that part of the food that goes to build up the bones and teeth.

It was found that it made a great difference in the health and growth of the animal how these elements were combined; if fed exclusively on either element he would soon become diseased, or, may be, die. Who would think of living on butter alone, or sugar, or even water,—except Dr. Tanner?

All three classes of elements must be fed—the proteids, the carbohydrates and the fats. But if either class is fed in excess, or is deficient, there is a waste. Then, too, with a proper amount of the carbo-hydrates or starchy food in the ration, the addition of the right amount of protein not only improves the ration by the amount of protein added, but also increases the digestibility of the starchy matter and the fat.

These facts are the basis of all fodder rations. A table has been prepared giving formulas for rations for different classes of animals, at different ages,—for fattening, for milk, and for growth.

To produce the largest yield of the best milk a cow can give, it takes, on the average, one and one-half pounds of protein, twelve and one-half pounds of carbo-hydrates, and four-tenths of a pound of fat per day for one thousand pounds of live weight. These figures represent the amounts DIGESTED of each group of elements in the fodder, not the whole amount fed, which must be in excess of the figures given. The protein, carbo-hydrates and fat, are the substances that are always digested from the food to nourish the animal, and the amounts given are in the right proportion to obtain the best results with milch cows.

To facilitate the application and use of these principles, tables have been prepared; Table I containing, as before stated, formulas for rations for all classes, ages and conditions of animals. Table II gives the composition of all on common foodstuffs. Table III shows what per cent. of each group of elements is digestible in each foodstuff and for different classes of animals. The numbers in the last table are known as "digestion co-efficients."

By the use of these tables we can calculate the correct ration for a single animal or for a whole herd, and when feeding said ration feel that we are putting our fodder to the best use and realizing from it the utmost.

It must be remembered that we are not working out a problem in mathematics; the solution is not an exact one. These formulas are but general directions, the closest approximations to the truth that have yet been made. To be strictly accurate would necessitate an analysis of each food stuff, and an experiment with each individual animal. But so many analyses and experiments have been made that the result of a general application of these formulas is very near the truth.

From the above it is plain that where a farmer uses corn fodder, and for grain corn meal, he has too much of the starchy food and far too little of the nitrogenous food, and there must be a waste. So, too, when to supplement his stock of feeding material he buys buckwheat middlings or the like and feeds with his corn he has made a mistake because he has simply added to his stock of starchy food of which he had already more than enough. The old gentleman who fed bran with his corn meal was on the right track, only he didn't go far enough; bran is a nitrogenous food, but it is not concentrated enough to balance up the ration he was feeding. When we attempt to fatten an animal on corn meal and herdsgrass we shall succeed if we keep at it long enough, but at what a waste of time and feed! The food of support uses up most of the profit.

The calculations necessary to make a practical application of these formulas are quite simple. Any one having a thorough knowledge of fractions and decimals is competent to make them. To a graduate of the Agricultural Department of the University of Vermont it would be like repeating the alphabet.

It may help towards an understanding and an appreciation of this subject to give a bit of experience, of actual trial of the foregoing principles:

We were supplying the neighboring village with milk, and winter milch cows being scarce and fodder and grain short, it was necessary to feed what we had so as to get the most milk at the least expense of fodder. All the rations were calculated according to Wolff's formula,* and made to conform to it as closely as possible. The ration varied from time to time, due to the giving out of some of the fodder and the substitution of others.

MANNER OF FEEDING.

The right amount of corn meal, cotton-seed meal, and malt sprouts for one feed was weighed out and mixed. The clover hay, corn stalks and some barley straw or wheat chaff were cut by horse-power; the main reason for cutting the clover hay was to ensure the eating of it as it had been somewhat damaged by rain. The cut fodder was weighed out and put in the mixing trough; it was then wet with cold water and the grain ration added and mixed. The cut fodder was weighed by getting the weight of a three bushel basketful a few times, and afterwards the weight was ascertained by measure.

When feeding time came this mixture was distributed quickly among the cows with a scoop, giving to each her proper share, according to her size, appetite, or condition with respect to calving. A little practice enabled one to do this very accurately. If the hay is a prime article most of it can be fed as well without cutting, only enough cut fodder being used to prevent the cows from bolting their grain.

Let me emphasize this method of feeding; by weighing out the ration the cows are always assured of a *regular amount* and *all* they want to eat, with *no waste*,—a result possible by no other way. When

*See Prof. Sanborn's article in Report of 1881 and 1882.

the amount is guessed at they are sometimes over fed, with a waste of fodder, or under fed, with a shrinkage in the milk.

As to cutting part of the fodder and mixing it with the grain; this is still more important. Cows are usually quite swinish in their manner of eating meal, and will bolt it without any attempt at chewing, and with just enough saliva to swallow it. A good share of the meal is never remasticated. If mixed with cut fodder it is again ground over by the teeth, thoroughiy mixed with the saliva, and put in the best possible condition for complete digestion.

All through the winter the different rations were relished by the cows. There was *no waste*, unless the pieces of cornstalk butts be considered as such. The effect was immediate and increasing, varying somewhat with the different cows. The herd was made up of common cows, mostly grades, such as we could buy in the surrounding country.

Eight cows out of the herd are given in the list to show the effect of the ration because they were milked continously during six months.

LIST.

	Whole No. days milked.	No. 1 Lbs.	Average. per day	No. 2	Average.	No. 3	No. 4	No. 5
Nov	24½	430	17½	387	15 8-10	442½	455½	542
Dec	31	577	18½	614½	18⅔	579	508½	678½
Jan	31	673	21⅔	658	21¼	535	544½	707
Feb	28	657	23½	618	22	504	287½	653
March	31	705½	22 7-10	662	21⅓	528½	651½	761½
April	30	705½	23½	673	22½	467½	647	601½

		No. 6	Average.	No. 7	Average.	No. 8
Nov	24½	788½	32 1-5	662	27	948
Dec	31	779		640		1192
Jan	31	830½		633		1078
Feb	28	790½	28¼	491½		1026
March	31	824½	26 6-10	492½		934
April	30	528½	17 6-10	419½	14	802

No. 1 was a farrow cow, twelve years old past, and had calved the spring previous; she was an especially ill-shaped, raw-boned, slope-rumped native, of no breed except cow. No. 2 was six years old; had calved the previous spring and was farrow; she, too, was a homely cow, and said to be part Jersey.

It is a prevailing opinion in some sections that when a cow has shrunk in her milk after the flush of the season is over, she can not to any extent recover from it before the next calf. What No. 1 gave on June feed we do not know, because we did not own her; but you will notice that she gained steadily from 430 pounds per month to 705 pounds, a gain of sixty per cent.,—more than half. No. 2 gained from 387 pounds to 673 pounds,—seventy-four per cent., nearly three-fourths. This it will be seen was a steady increase during the six worst months of the year, when by all the rules known to dairymen there ought to have been a steady decrease. This will apply to nearly all the cows on the list, though it appears more marked in some than in others.

This shrinking during the season will be seen not necessarily permanent, and while it may be partly true of some cows it is wholly true of none. The whole question seems to be one of feed and shelter. And we can say this in part of all milk production ; it is quite as much a question of feed as of breed. If our common cows were well fed and cared for, they would give us handsome returns, and there would be less necessity for large expenditures in fancy breeds. Many a man has left the possibilities at hand to obtain the same or less results at much greater expense.

Let me call your attention to No. 6 and 7. We found that when a cow had a tendency to lay on fat like a Shorthorn, or Hereford, while giving milk, that tendency was increased by the rich ration ; and, as is always the case, at the expense of the yield of milk.

No. 6 was a large Shorthorn grade, with a well-developed udder and beefy appearance ; she had calved in October. She gave a good yield for five months, when she began to fatten and her mess dropped rapidly from 26.6 pounds to 17.6 pounds.

No. 7 calved the last part of October. She was a fine-looking cow, short legged, well-formed, and always in good condition. She had an unusually large udder and gave apparently fine promise of a good yield. Her mess dropped steadily from 27 pounds in November, to 14 pounds in April, when she was dried off and fattened for beef.

We noticed that when any change was made in the ration either by varying the proportions of the component parts, or by substituting others, there was invariably an immediate shrinkage in the yield of milk ; and this was the case though the resulting ration was equally as good as the former one. The cows would gradually recover from this after a few days when they had become used to the new ration. This is worth thinking about for those who advocate a continual change of feed. It is well to have a good variety in the ration, but not to be changing the ration for the sake of variety ; it is apt to give a little too much of it.

Following this system of feeding in March, the cows had shed their coats and were as sleek as moles, having an appearance fully equal to that on June pasture. They were in excellent health, vigorous and active. We had no sickness among them whatever, except one case of premature birth, due to our own carelessness in feeding a full feed too close to the period of calving ; it is seen in No. 4, in the list for the month of February.

The object in feeding our cows in this way was the production of the largest quantity and best quality of milk for sale in the neighboring village. For that purpose it has no superior, either for economy of food or amount of product of pure, wholesome milk. It may be possible to produce a large yield of a whitish fluid by feeding distillery slops or glucose refuse and the like. When the quality of the milk is taken into consideration, and the health and condition of the cows, there is no room for choice.

These fodder rations made success possible with us where failure would have been the inevitable result had we depended on corn meal and cornstalks or hay. We added to them cotton-seed meal and malt sprouts.

From the foregoing we see that the last one-third in the full ration, from which one-third the profit comes, depends on the right combination of the different feedstuffs so as to secure the proper amount of protein, carbo-hydrates and fat; it is a question of the kind of feed, of the amount, and of the proper combination.

Will it pay us to buy any additional feedstuffs? Most emphatically, yes. We cannot combine our ordinary grains so as to make a perfect ration, and it will pay to have some concentrated nitrogenous feed, such as cotton-seed meal, linseed meal, or malt sprouts, if we have to sell part of the cows to buy it with. Besides they are the cheapest feeds in the market for the amount of nutriment they contain. Being concentrated food they must be used with caution by those unaccustomed to them.

We found men in various parts of the State of Vermont, where the dairy interest predominated, who had hit upon a nearly correct ration, near enough for all practical purposes; and they were all well pleased with the system they were following, and had no thought of changing.

Many questions will suggest themselves which the limits of this paper do not permit me to touch upon, such as the necessity and economy of warm buildings, ventilation, cleanliness, regularity in feeding, how a rich, *i. e.*, a full ration, will affect an animal for breeding purposes, how it will affect the duration of the milking period during each season, and whether it will lessen the total number of years in milk, the effect of cotton seed meal on milk and butter, how large a quantity may be fed, and many others. There are many men in Vermont whose experience would throw valuable light on these topics.

In conclusion, let me ask a careful and candid consideration of these improved rations, and a steady progress out of the old, wasteful ways into the new ones of better promise.

A FEW THOUGHTS ON AGRICULTURE.

By FRANK D. HALE of Lunenburgh, Vt.

The first thought in the mind of all legislators should be, " the well being of the people whom I represent, the welfare and prosperity of my state or country ;" this thought, I think, was first in the minds of Vermont's law makers, when " the State Board of Agriculture " was established. The peculiar interests of our state were to receive more prominence, and the people were to be educated by observation and experience in those departments of learning which, by the right direction of labor, moved by a new and stronger impulse, should result in the most bounteous and profitable harvests.

The members of " the Board " have been welcomed to many a town in the State ; not merely because they are citizens of our beloved commonwealth, and are interested in its welfare and prosperity ; not alone because they are brothers in this great sisterhood of states, and join their mental and physical labor with ours in order to maintain those principles of governmental policy which give to all the people of this great land the blessings of liberty and equal rights, education and Christianity, but are more especially welcomed because they are co-thinkers and co-laborers in the great fields of agriculture ; that sphere in which nearly one-half of the whole population of the United States find their life work, upon whose labors 25,000,000 of our people directly depend, and who, directly or indirectly, with the sweat of their brow sustain the fifty millions of our people, aye more, who with the surplus of the products of their labor help to sustain the millions of the old world. Vermont is pre-eminently an agricultural state. The richness of her soil overcomes the unfavorable peculiarities of our severe climate ; and the honesty and integrity of our citizens, their strength, physically and morally, removes the sometimes dangers, which are threatened by our hard hearted granite neighbors, and companions. The world over, the children of agricultural states and districts never have been, are not to-day, and never will be afraid to stand the test of trials, persecution or affliction ; never feel to blush with fear when called upon to meet the children of other callings and other spheres. There is something about this work with old mother earth herself which gives a healthy vigor to our physical being ; something in this hourly companionship with sun and rain, with stars and dew, with grass, tree, and soil, which gives that independent contentment to the mind, which is the golden charm of life ; there is something truly ennobling in this gift of our time and strength, for the sustenance of the teeming millions of the earth ; something in this copartnership with great nature and her laws, which tend to draw us nearer to nature's God ; but notwithstanding all this, there has been

a prevailing idea in the past, especially among our young men and women, that farming was a little too menial and too unremunerative to offer any especial attractions to their youthful ambitions; they have had the dangerous idea that farming was too slow for boys of this modern day; it was beneath their dignity; their ambitions have led them to view afar off the fields of fame and renown with eager eyes, and these, they say, come not to the agriculturalist; there has been too much of the teaching that the bright boy must go to the city, and learn to measure the silken fabrics by the yard, to weigh the sugar and soda by the pound, and count clothes pins by the dozen; he must go to college and familiarize himself with the philosophers and poets of ancient times; he must go into fashionable society in order that his manners may become those of a polished gentleman; he must prepare to adorn some profession, while his apparently less quick and bright brother is kept at home to hold the plow and milk the cows. The world is full of blunders made this way. I say there has been too much of all this show and desire on the part of parents as well as their children, for an entrance into a falsely so-called more honorable sphere of activity; I am glad to say there has been of late a seeming reaction in this matter, and to-day, throughout America, the science of agriculture, (for it is a science) is being recognized as foremost, and well worthy the honest labor of the uncalloused hand, and the best thought of the educated and trained mind. This idea before spoken of has had a tendency to depopulate our farming sections; to allow decay and mould to foreclose claims upon houses, barns and fences; and to impoverish the soil itself, which has been willing ever to give of her great wealth, but to which little has been given in return. Vermont farms to-day suffer from this terrible neglect; emigration has been the great energy of our state, and this emigration has been the direct result of this desire, on the part of young men, for an *easy* life, for wealth, for position, for city pleasures. To-day there are living in other states over 100,000 people who were born in Vermont. These, with descendants born outside the state, would make a population as great as that of our State to-day.

I sincerely believe that if our 35,000 farms were made into 70,000, that our resources would be sufficient for the support of a population more than double what it now is; and our farm products instead of being 25,000,000 a year would soon reach 100,000,000. The key to this is found in the fact that ten acres well cultivated will produce as much as thirty acres poorly cultivated. It is not so much the amount of labor bestowed upon a piece of land, as the kind of labor. Quality superior to quantity in this matter. One man will tease twice the product out of a piece of land with one day's labor that another will with a day's labor. One's labor is educated, the other uneducated; one is skilled, the other unskilled; one scientific, the other not. Agriculture is a science if our farmers will only make it so. There is one great trouble with many of our farmers; they are like the philosophers of old, who, when Columbus said "the world is round," laughed at the idea; ridiculed it. It was not according to the way in which they had been trained. Civilization is advancing; universal educa-

tion is offered to the entire world, and I believe agriculture is gaining ground upon the other employments of mankind.

Our agricultural interests will develop; our farm buildings will indicate more conspicuously the touch of the hand of thrift: our tillage fields will yield more abundant harvests, aud our pasturage be the home of larger droves of better cattle, if we can check this tide of emigration from our borders, of the stalwart young. I believe that great and good man, Thaddeus Stevens, placed an unjust stigma upon the fair reputation of Vermont, when he said "she is a good State to be born in provided you emigrate soon enough." If Vermont is a good State to be born in, surely the influences of her homes among the hills, and by the rivers, are safe ones in the formation of character; in the preparation for the work of life; yes, for that work itself. Let Vermont farmers keep their boys and girls at home. Let them make their homes to possess attractions for youthful minds, and affections for youthful hearts; let them get off the notion that boys and girls must work much and play little; young folks do not like that continual drudging which many farmers make their work to be; let them use some means by which to make the old farm possess some attraction for the boys; let them see sure reward as the result of their labors—give them opportunities for study and reading; help them to enjoy society and to form safe friendships for life. Children are not old people; children must have amusements mixed with their labors, and, fathers, it will do you much lasting benefit to help amuse them. By all means give them good books; I believe the pure loving influence of home, mildness, rather than severity, and a keen appreciation of the different wants and needs of differing constitutions, together with shelves of books of travel and biography, history and fiction, are better character builders than four years with the curriculum of a Yale or a Harvard; there is more solidity in it; more of the practical and less of the theoretical; more of the real and less of the visionary. I say, then, labor to stop this devastating tide of emigration. Make farm labor less master, and more friend and companion.

We want to make our labor pay us better. We want the greatest product from the least expense. We want to make our farming a study. We want to learn something new about it every day. It is truly worthy our best strength and thought. We want to make it so our young men, and women as well, (for men cannot farm successfully without helping wives,) will be interested in it. If it could be made as attractive to them as the gay and dangerous frivolties of city life, there would be fewer of our country boys and girls to find their ruin in the temptations of the metropolis.

As I said to begin with, we have excellent advantages for agriculture; we have soil which is possessed of the sources of bountiful harvests; our climate is suited to our principal cereals and other crops; our pastures are excellent for grazing purposes; we raise more corn to the acre than any other State in this Union; in the average yield of wheat we are second to but one, and in oats and potatoes excelled by but three or four. If such be the case now where would be our

rank if we doubled our exertions, and studied as hard over the causes and results of farm profits, as do other classes of people in their several callings? We have good laws, good morals, noble-hearted men and pure-minded women, good schools, and numerous churches; we are a healthy, sturdy people; why shall not our agricultural interests be developed to such an extent that, though small in area, yet shall we be in the front rank of prosperity and influence for the right?

THE RELATION OF NATURAL HISTORY TO AGRICULTURE.

[A paper read at the meetings of the Board of Agriculture, by GEORGE H. PERKINS, Professor of Natural History in the University of Vermont and State Agricultural College, Burlington.]

That the farmers of Vermont should have some knowledge of natural history scarcely needs proof, nor will it be doubted, I think, that more of this knowledge than most of them possess would be highly advantageous. Nevertheless, while not disputing these statements, how many farmers are ready to make it a part of their daily business to study systematically any branch of natural history? Some already give both time and thought to this matter, but comparatively few, I fear, really feel the importance of such study. It is the design of the following pages to suggest,—there will not be space for more than this,—some of the great advantages which may accrue from earnestly engaging in a study of animals or plants or both. Many are deterred from attempting this by the belief that if they are to do any valuable work it must be under the direction of competent teachers and with the aid of suitable books. It would, very probably, be a wholly unsuccessful project which called the farmer to leave his crops and betake himself to some institution where science could be taught him. Doubtless every farmer would be benefitted by such a course, but many can not, and many will not listen to any proposition which involves this. Fortunately it is not necessary. To study natural history aright the farmer, as well as every one else, must go to school; he must have a good teacher and good books, but the school in which natural history is best studied is the wide world—the farmer's school room is his meadow or cornfield or wood lot, his teacher is nature herself and his books are the objects themselves. All books of nature written by men, however easily arranged, however valuable, are at best only aids. They are letters of introduction which may serve to make one acquainted with nature more fully than he would be without them, but, like other letters of introduction, they can only introduce, as they can never make us know a man or make him our friend. If this is ever to be the result of our acquaintance it must come from direct personal contact, we must gradually learn what the man is to admire him because we find him worthy of admiration, and it is the same with nature. Botanies, zoologies, works of natural history, may make us eager to know more of nature, they may even arouse enthusiasm for the study and they may help us to the best modes of study, but only as we know the objects of which they treat—the animals and plants themselves—can we have a true knowledge of natural history.

If this be true, if in order to a right and successful study of nature we must know not merely what some one has said of her, but herself; certainly few have so great opportunity for such study as the farmers. From morning till evening through the year the farmer's work brings him into closest contact with nature. It is with animals and plants, with all the many influences that affect their growth and development, that the farmer has to do, and just in proportion as he knows what to do to meet the conditions of success, will he succeed. And it will be evident to all that while no one has so great opportunity for becoming closely acquainted with nature as the farmer or fruit grower or forester, so no one has more need for such acquaintance.

I would not be understood as urging that books are of no value; such is not at all the case, but they are to be always used as means to the study of natural objects, not as taking the place of such objects. They have their place, and an important place it is, but they must be kept in it. I would then urge the farmer, or anyone who has to do with agricultural operations, to study as regularly as he can the animals and plants. What most frequently comes under his observation, I would have him study them by using his eyes to see all that there is to see, by investigating their habits, structure, modes of growth and all else that he can. A very short trial of this method of studying nature must convince the student both of its pleasure and profitableness. Its effect upon the mind and heart of the student is hard to be overlooked. It will bring fact after fact to the diligent worker, and finally give him a store of information which for practical purposes will prove invaluable, but this is very far from being the whole of the gain. As the very foundation of all study of nature, his observation and the study will be useful and successful as the habit of keen, accurate, persevering observation is gained. But this same habit of observation so essential to all scientific work is in and for itself of the highest value in every kind of work. An observing man is far more sure of success in whatever he undertakes than one who is not. No one doubts this, and if it is true, whatever encourages and increases the power of observation must be of value for this reason aside from whatever other value it may have, and I venture to say that there is no other branch of study that so effectually does this as natural science. The man who has learned to watch the habits of birds, or insects, or other animals, has at the same time learned to notice the habits of his fellowmen, and can better regulate his actions in his relations with them, and the same is true of everything else. But observation, while perhaps that faculty of the mind which is chiefly cultivated by this study, is not the only one. When one has observed the characteristics, or some of them, of any natural objects he proceeds inevitably to compare one with another, to decide whether these two are more nearly alike than those other two, or whether either is more closely allied to a third. In this process of comparison, and the consequent bringing together or separating, the mind must exercise its powers of judgment and discrimination, and these are of use elsewhere than in the study of animals. There are other faculties which are called into active exercise by such study, but they cannot be dwelt upon here.

When he who is depending for his support upon any form of agricultural labor, sets in order before him the many uncertainties and obstacles that beset his work; when he sees how many contingencies may arise, against which he is nearly or quite powerless to provide, the many various insects that may attack and injure or even destroy his crops, the weeds that choke out the grain, he may well feel that farming is not a very sure business. And yet, when he looks about him and sees what he has himself accomplished, and his fellow laborers as well, in spite of these untoward circumstances, he may well take heart and feel that man, at times so utterly helpless and powerless before the forces of nature, is after all master of the situation, and though sometimes the loser, is on the whole the gainer. And more than this, agriculture is less uncertain than it once was, and is likely to be more and more sure of its methods in the future, although necessarily affected by influences, the effects of which cannot be foreseen. One thing is sure, that the farmer needs to call to his aid every ally available, and to know everything he can discover relating to his work, in order that he may the more effectually overcome the enemies and hindrances which will inevitably beset him. Everyone who will study nature patiently and carefully will be surprised when he finds how much, not only of profit, but of pleasure, he has gained and of interest as well, for such study well begun and persistently carried on is its own sufficient inspiration. As soon as one has learned a little of nature he wants to know more and then more and so on, never reaching either the limit of his desire to know or exhausting the material which he is studying. Nor is the knowledge a selfish knowledge, no real knowledge is, but when one has discovered new facts he may bestow his acquisitions far and wide for the benefit of all who care to use them.

The agriculturalist may also not only help his work directly by giving his attention to the study of nature, but indirectly by helping those who in turn may help him. Just as the farmer needs all the help the zoologists and botanists can give him, they need all the help he can give them. I believe special students of natural science have done very much in aid of agriculture, far more than some are willing to give them credit for, but they have each of them but one pair of eyes and of hands, and their range of observation is necessarily limited and many a lack which they find in their observations as they carry on their work may be filled by what one and another has noticed, but most likely thought of too little value to be made known. If the farmers will take hold heartily with the entomologists and botanists and other naturalists they will be able by their combined efforts to achieve greater victories over the foes of agriculture than have yet been gained, and thousands of dollars, besides very much vexation, may be saved. A habit of close and accurate observation will be of very great value in that work for one of the greatest obstacles which the practical naturalist, for instance the entomologist, meets with in the inability of those who have seen a given insect that may be ravaging a crop, to relate satisfactorily either to themselves or to him what they have seen and what they know. Having neglected to ob-

serve, they have not learned how to do it sufficiently when they wish to, and suffer in consequence. Many farmers are ready enough to ask questions as to the habits of insects or other animals which they ought to have observed for themselves. The scientist can not do all that needs to be done, they need the co-operation of the agriculturists. And the scientists, some of them, need watching, for not all who bear the name are trustworthy, and the farmer who has studied for himself the habits of animals, will be thereby better able to judge as to the probable effect of proposed remedies for their ravages. He will be better able to distinguish true science from science falsly so-called and this is not of little importance as many a farmer knows to his cost. A mistake is often made by those without scientific training in that they believe that all is known already that can be known of the structure and habits of common animals, and they hesitate about devoting their energies to the investigation of these because they suppose that in so doing they will be doing over what has already been done before and what they see they do not tell lest it shall be a twice-told tale.

The fact is that naturalists have only a very imperfect knowledge of many very common objects. The number of animals whose structure and habits are anything like fully understood is not large, and I doubt if there be one which may not reward the close student with new facts. Hence none need fear lest his labor be in vain, for even if he discovers nothing new it is often quite as important that what has been reported as true receive the confirmation of further observation, as it is that new facts should be discovered. All around him the farmer who cares to know may find the sources of knowledge. He need not wait for rare or strange creatures, but take such as are at hand, and feel sure that he may do good service both to science and agriculture. Let him begin with the insects that are at the time infesting his crops, and, without asking others, seek to know for himself where each species lays its eggs and what sort of eggs, when their eggs hatch and under what conditions, into what sort of a grub they develop, how long this grub or larva lives upon what it feeds, (he very likely knows this only too well already) whether it can thrive upon one sort of plant or several, whether any of the weeds that fringe his field afford it a harbor if he succeed in driving it off from his crops. He may find out how long it slumbers in the chrysalis, and where this is found, and in what form it appears as perfect insect. All these things and more need to be known if the fruit grower or farmer is to be most successful in fighting his insect foes. And he must not confine his attention to those animals that are injuring him. He needs to know his friends as well as his foes. If he is devoting his attention largely to insects, he may find that there are not only injurious insects, but others which not only do no harm, but destroy those that are harmful. Perhaps some will think that in such a study there will be much drudgery, but it will be found to be quite otherwise, for nothing in the whole range of study can be more replete with interest, more abounding in strange revalations, more full of unexpected discoveries, than the life history of any animal or plant. The student of entomology, for instance, finds himself delighted and astonished

because of the strange transformations which many insects undergo, or the marvelous exhibitions of instinct and even intelligence which some make, or the structures which others make and inhabit, the silken mats or webs woven, the underground cells excavated and lined with varnish, wool, or silk. Here is a worm which hangs himself up by a loop and goes to sleep to awake a butterfly; there is one who lives in the water of a brook and makes a tube of sticks in which he lives for weeks, until finally he bursts forth and mounts into the air a gauzy-winged creature; there is the dandy of the caterpillar world, a spiney little fellow who uses his spines not to prick his neighbors with, but as pins upon which he thrusts little bits of papers and shreds of cloth until he is so decorated that his nearest kin would never know him. And so on, each with its own peculiar and interesting habits, we find them, building, burrowing, spinning, weaving, boring, some in the water, some on land, some in the air, some now in one element and now in another. Surely he must be a very dullard who can find only drudgery in the study of such creatures, and this world of ours, that so many find rather uninteresting on the whole, is full of just such. Nor do the insects monopolize all that is interesting in zoology. Perhaps no other group of animals may so undesirably obtrude themselves upon the attention of the farmer, but he will need to study other groups as well, and indeed he will find group so related to group that the study of any one will lead him on to that of others, and these of others. If he has studied insects he has found that birds eat insects, and that as a part of his study of the remedies which he may use for the destructiveness of insects, he must include birds. And we need to have a great deal more accurate and trustworthy knowledge of even our common birds than we possess. There are some, as the bluebird, wrens, titmice and swallows, about which there does not seem to be much dispute, all agreeing that these are useful, or at least not injurious. While as to others, such as the robin, cat-bird and woodpeckers, the observers are divided, some, the majority, regarding them as on the whole highly useful, though not free from depredating habits, while others regard them as harmful. And there are yet others, as the crow and blackbirds, which have many friends, and yet are generally considered to be enemies rather than friends. Now it is not by any means an unimportant question whether a common bird is to be encouraged or discouraged in its occupation of our gardens and yards. The answer to this question may involve thousands of dollars. It has more than once. It is often better not to meddle at all with nature's arrangements, than to interfere without sure knowledge of what should be done. Errors cannot, of course, be wholly prevented, but their number and magnitude may be lessened by abundant and careful observation, and by a comparison of different observations. Every one can observe the birds that come into his garden or dooryard, and by so doing he may add his quota to the general fund of knowledge. It must be in this way rather than in any other, by the aggregation of small facts that our knowledge must be gained. On this account it is not only important to observe, but also to discuss and compare observations. A company of men may

come together, one having discovered one fact, another a different, and by bringing together all the fragments, the whole may be built up. Again, when observations contradict each other, those who made them will be led to revise their work and correct their errors. Any man studying alone, however careful he may be, is liable to make mistakes, and needs the help of other workers that he may have his errors pointed out. Nature bears some of her truths so freely exposed that he who runs may read, and only the veriest blunderer can mistake their meaning, but many, and these are most important, are not so easily discovered; they must be sought diligently, and they often are obscured by very misleading appearances. It seems sometimes as if nature were playing at hide aud seek with the student, and if he be superficial and content with partial investigation he will be deceived. Every student of nature must have noticed how unlike the real character of an animal sometimes is to that which seems to be indicated by some of its actions, so that the seeming enemy is found after all to be a friend, or the seeming friend a foe. Especially is one liable to fall into error if he observes an animal, be it insect, bird, or other animal, during but a part of the season, for it is not at all uncommon for habits to change with age or season. Only as one knows the whole history of an animal is he competent to decide as to its character, and he must know this in more than one place, for the vote for or against an animal may be materially affected by the returns from other towns. Many local influences affect largely the habits of animals—a great abundance or scarcity of food, difference of temperature, and many unexplained and to us unknown causes operate in this manner. Where small fruits are abundant and other food scarce, birds will commit greater depredations than where all food is abundant, though there may be as much fruit in one place as in the other. Another reason why farmers should get together and discuss natural history, among other topics germane to their work, is the encouragement which such discussions would certainly give to any who might be weary or faint-hearted in the work.

The study of natural history is full of surprises. Intricate and wonderful structures, singularly beautiful adaptation of part to part, and many other interesting facts are continually appearing where least expected, and many animals little thought of, or thought of only with aversion, are found to be deserving of very different regard. This may be illustrated by the toad. This animal, which is not often liked by those ignorant of its habits, is found to be a most valiant destroyer of insects, and if one will observe its habits, he will find them extremely interesting. So, too, we are just beginning to find out what angle-worms have been doing for agriculture for centuries in the way of pulverizing the soil, grinding up vegetable matter, and in other ways making the soil more productive. Whether we shall find that we can accord to earth-worms all that Mr. Darwin claims for them, remains to be seen, but that future observations will confirm us in our opinion of their value cannot be doubted. Certainly, earthworms are common enough, but how many of those who have for years seen them have ever suspected the real nature of their work?

New facts are thus continually coming to light respecting common animals. Only a few months ago I was told of a fact new to me and I presume to most, respecting the raccoon. The common white grub had been devouring the grass roots in some of the meadows in one of our towns, and one morning the owner going over the field found the earth rooted up in many places, and all about were tracks as if a company of babies had been dancing there. The raccoons had come in the night and fallen upon the grubs, rooting them out of the sod and devouring them. All such facts we need to know, for very few animals have so clear a record that we can at once decide how they stand. Most are sometimes depredators and sometimes benefactors, and we must determine the relation between the good and evil before we can strike a balance.

Turning from zoology to botany, we find another vast and important field opening before us. We have on the one hand the great group of weeds, some of which prove no slight pests, and on the other the structure, mode of growth and development of cultivated plants.

It seems evident enough that those who are engaged more than other men in the cultivation of plants, should more than others understand how plants grow, what conditions are favorable and what unfavorable to their growth and reproduction ; how the different parts of the plant develop and grow ; how the whole plant is constructed. Will not the farmer who knows something of all this be a better farmer? Will he not raise more corn, or wheat, or potatoes on every acre planted if he knows not only how to sow and reap, to cultivate and fertilize the crop, but also something of the wonderful processes of growth and development which have produced each stalk and blade? Will his crop be of less value to him, will its cultivation be less pleasant if, as he rejoices in its flourishing and the abundant promise of harvest it may give, he remembers how those golden grains are being produced by the action of mighty forces, silent indeed but unspeakably powerful? Will he not harvest his larger crop with greater delight and be a larger and better man for the knowledge. Other things being equal, is not an intelligent farmer a better farmer, and the better the more intelligent? Yet some people have strange notions about this.

A knowledge of the growth and modes of scattering seeds, etc., of weeds will be serviceable in helping the farmer to destroy pests. There is a department of botany little cultivated hitherto in this country, which is now coming to be of increasing importance—the science of forestry. So long as this country had more trees than it could use, no one but a few botanists cared to study the growth of trees and the best methods of cultivating them, but now that a scarcity of timber is threatening us in the not distant future, more attention is very naturally paid to forestry. Already has tree planting upon a somewhat extensive scale begun, and it is sure to increase, and with it the study of botany must also increase. I might also speak of geology, for, as that science treats of the origin and formation of soil, the disintegration of rock masses and other similar subjects, it has a practical use for the farmer, and the same is true of chemists, but I can only allude to these and to meteorology, which also involves more or less of the science of physics.

Every science is, and of necessity, at the beginning, largely empirical. It gropes its stumbling way along its unknown course, often wandering far from the right path, often forced to turn back its steps, often in perplexity and doubt, often in error, it yet on the whole makes progress in the right direction. This is as true of agriculture as of other sciences, as anyone may see who will compare its condition at present with that one or two centuries ago, and trace its course through the years that intervene. As an art, agriculture is oldest of all, unless, possibly, hunting and war preceded it. But these, before agriculture began, were in so rudimentary a condition that they can scarcely be called arts. As a science, however, agriculture is by no means so ancient; it has, indeed, only in recent years earned the right to that title. It was scarcely a science, hardly even an art in those good old days when, instead of fighting the predatory hordes of bugs with Paris green, or tobacco water or hellebore, the powerful aid of the church was invoked, as it was more than once, and the audacious bugs that ravaged the crops of the faithful were cursed and placed under the ban "in the name of the Holy Trinity and the Blessed Virgin." Even in Canada, an old writer tells us, that the animals paid so little heed to the denunciations of the priests that certain wild doves which were doing much damage to the crops had to be excommunicated several times before they ceased. Such methods savor of the spirit of the age rather than of science, but I am sure that the modern farmer finds his more scientific methods decidedly more efficacious against the bugs than his comrade of old found the priests and bishops.

But we have not yet reached perfection. There is a wide field of research, there are possibilities and there are certainties before the farmer, and if he makes use of all the means at hand he may realize many of these. In its progress agriculture has been asking of botany how plants grow and how they are formed and increased, of zoology what animals should be fostered as useful and what destroyed as injurious, of chemistry what sort of food does this or that crop need and where best it can get it, of geology what sort of soil will be found in this region or that, what sort of material will this or that rock furnish? And all the time agriculture has changed from a simple, almost wholly experimental labor to one which is very complex. A man to be a successful farmer to-day must be a more intelligent and thoughtful man than he of the past. This need not be in anywise regretted save by dolts and stupids, who find themselves possessed of too little brain power to keep up in the race, and they must work for some one else. The successful farmer of to day is more successful and more certain of continued success than was the farmer of a century ago, and it must continue to be so. As other arts and sciences make progress, so must agriculture. There is no help for this. It must every year require more scientific knowledge, more acute observation, more general intelligence to manage properly a large farm than it did the year before, and those who are to-day most keenly alive to the truth of these statements, who see most plainly how complex a science agriculture is, how closely connected with all natural science, will be the successful farmers of the future.

CATALOGUE OF THE BIRDS OF VERMONT.

By Hiram A. Cutting, M. D.

Being urged to prepare a catalogue of our birds, to aid those that desire to gain some knowledge of Vermont ornithology, I have prepared the following, with notes largely from observation, but where that has failed, I have, as in classification, adopted the opinions of W. A. Stearns and Dr. Elliott Coues. Though I do not expect I have noted every bird that may be found in the State, I trust it may be reasonably correct. I have added some notes of their nesting habits and peculiarities, that I hope may be of benefit to the young, that desire knowledge, and yet have limited means of acquiring it, as I believe such notes may lead many times to identification. The following are the families or

DIVISIONS.

Family	Turdidæ	Thrushes.
"	Saxicolidæ	Stone Chats, &c.
"	Sylviidæ	Sylvians.
"	Paridæ	Titmice.
"	Sittidæ	Nuthatches.
"	Certhiidæ	Creepers.
"	Troglodytidæ	Wrens.
"	Sylvicolidæ	American Warblers.
"	Tanagridæ	Tanagers.
"	Hirundinidæ	Swallows.
"	Ampelidæ	Waxwings.
"	Vireonidæ	Greenlets.
"	Laniidæ	Shrikes.
"	Fringillidæ	Finches.
"	Icteridæ	American Starlings.
"	Corvidæ	Crows and Jays.
"	Tyrannidæ	Flycatchers.
"	Caprimulgidæ	Whippoorwills and Nighthawks.
"	Cypselidæ	Swifts.
"	Trochilidæ	Humming Birds.
"	Alcedinidæ	Kingfishers.
"	Cuculidæ	Cuckoos.
"	Picidæ	Woodpeckers.
"	Strigidæ	Owls.
"	Falconidæ	Hawks.
"	Cathartidæ	American Vultures.
"	Columbidæ	Pigeons.
"	Tetraonidæ	Grouse, Partridge.

WATER BIRDS.

Family Charadriidæ.........Plovers.
" Scolopacidæ.........Snipe, &c.
" Ardeidæ............Herons.
" Gruidæ.............Cranes.
" Rallidæ.............Rails and their Allies.
" Anatidæ.............Swans, Geese and Ducks.
" Phalacrocoracidæ.....Cormorants.
" Laridæ.............Gulls.
" Colymbidæ..........Loons.
" Alcidæ..............Auks.

FAMILY TURDIDÆ.—Thrushes.

Robin. *Turdus migratorius*, Linn.

Summer resident, everywhere abundant; a few individuals remain through the winter. A mischievious bird, destroying much small fruit.

Wood Thrush. *Turdus mustelinus*, Gm.

Summer resident. This is the famous vocalist whose delightful song enlivens the dawn as well as the sunset during the mating season. Not very abundant.

Hermit Thrush. *Turdus pallasi*, Cab.

Breeds in northern part of the state. Inhabits low, dense woods. A sweet singer, but only sings for a few days during the nesting season.

Olive-backed Thrush. *Turdus Swainsoni*, Cab.

Quite common in northern Vermont. Scarce in southern portions, where it seldom nests. Has a pleasing song while nesting, but at other times a sharp abrupt call note only. Usual resorts like the hermit; but does not nest on the ground.

Gray-cheeked Thrush. *Turdus Swainsoni aliciæ*, Coues.

Common, but migratory, though a few are said to breed in northern Vermont. I have never seen a nest.

Tawny Thrush; Veery. *Turdus fuscescens*, Steph.

Quite common in southern part of the state, but rare in northern part. The Thrushes can be easily distinguished by the color of the upper parts alone. The Wood Thrush is tawny, turning to olive on the rump. The Hermit is olive, tawny on the rump. The Olive-back is entirely olive. The Veery is entirely tawny.

Cat Bird. *Mimus Carolinensis*, Gray.

An abundant summer resident in every part of the state. It may be classed with the beneficial birds, but it is not a favorite, probably on account of its cat-like cry. Yet it is an incomparable mimic.

Brown Thrush ; Thrasher. *Harporhynchus rufus*, Cab.

Common in some parts of the state. Scarce in northern part. Its song is little inferior to the mocking bird, but its songs of mimicry are much more restricted.

FAMILY SAXICOLIDÆ.—Stone Chats, &c.

Blue Bird. *Sialia sialis*, Hald.

Abundant throughout the state. A very beneficial bird. It will nest in tin fruit cans or boxes nailed on top of fence posts, if perforated so that the water can run out.

FAMILY SYLVIIDÆ.—Sylvians.

Ruby-crowned Kinglet. *Regulus calendula*, Licht.

Common in northern Vermont, where it breeds. Their song is a sweet warble. It is a restless bird.

Golden-crested Kinglet. *Regulus satrapa*, Licht.

Breeds in this state, and often some of them remain with us through the winter. It may be called a permanent resident.

Blue-gray Gnat Catcher. *Polioptila coerulea*, Scl.

Said to be rarely seen in southern part of the state.

FAMILY PARIDÆ.—Titmice.

Black-capped Titmouse ; Chickadee. *Parus atricapillus*, L.

A common resident during the year, but perhaps more abundant in fall and winter ; at least more noticable. Sleeps with his head under his wing.

Hudsonian Titmouse. *Parus Hudsonicus*, F.

Breeds in northern part of state ; and in some places is common, but rare in southern part.

FAMILY SITTIDÆ.—Nuthatches.

White-bellied Nuthatch. *Sitta Carolinensis*, Gm.

A common bird, residing the year round. It feeds on insects and is a desirable bird. It has a peculiar song and a low gutteral tone. If once heard it is always remembered.

Red-bellied Nuthatch. *Sitta Canadensis*, L.

Common in north part of state, and often seen in all portions, but perhaps does not nest often, only among the northern hills. Its habits and food much the same as the other.

FAMILY CERTHIIDÆ.—Creepers.

Brown Creeper. *Certhia familiaris*, L.

Common in most towns in the state, nesting here. It is a shy bird, but not alone found in the woods, as it is often observed in our orchards, parks, and even streets. Is one of the most servicible of birds as it lives largely upon noxious insects that are found in the crevices of the bark of trees.

FAMILY TROGLODYTIDÆ.—Wrens.

Great Carolina Wren. *Thryothorus Ludovicianus*, Bp.

A rare visitant, said to have been seen at Bennington now and then. Has not been known to breed here.

House Wren. *Troglodytes domesticus*, Coues.

A summer resident, breeding in southern part of the state. Is social in its habits, and hence if one pair is found in a neighborhood more are likely to be, and the same birds doubtless return year after year to the same breeding grounds.

Winter Wren. *Anorthura troglodytes hiemalis*, Coues.

One of the smallest birds with a pleasing song, yet of a retiring nature. Breeds in the state, and yet is not often seen as it is always on the wrong sides of a branch.

FAMILY SYLVICOLIDÆ.—American Warblers.

Black and White Creeping Warbler. *Mniotilta varia*, V.

A beautiful and interesting summer visitor; nest usually on the ground. Is insectiverous, and hence welcome.

Blue Yellow-Backed Warbler. *Parula Americana*, Bp.

A common summer resident coming among us in January. Nests in trees, building near end of branches a beautiful hanging nest made mostly of moss.

Nashville Warbler. *Helminthophaga ruficapilla*, Bd.

Breeds here in great numbers. Nests on the ground. Builds of leaves and bark of white birch and other trees. Sometimes uses pine needles.

Summer Warbler; Summer Yellow Bird; Yellow Warbler. *Dendroeca aestiva*, Bd.

This beautiful bird is abundant, nesting in orchards and gardens, and is one of the most valuable as one of the most plentiful of man's friends.

Black-throated Green Warbler. *Dendroeca virens*, Bd.

More abundant in northern part of state, especially in pine woods of Essex County.

BLACK-THROATED BLUE WARBLER. *Dendroeca coerulescens*, Bd.

Abundant in northern portions of state, but not as familiar in nesting. A beautiful and desirable bird.

YELLOW-RUMPED WARBLER; MYRTLE BIRD. *Dendroeca coronata*, Gray.

Abundant among the hills in spruce woods. Builds nests in low spruce trees, from three to five feet from the ground. Builds of twigs and lines with feathers.

BLACKBURN'S WARBLER. *Dendroeca Blackburnœ*, Bd.

Quite common. Builds in high and mossy evergreen trees. Lines nest with an abundant supply of feathers.

BLACK-POLL WARBLER. *Dendroeca striata*, Bd.

Is chiefly a migrant, seen spring and fall, yet a few nest on the northern border of the state. Nest built of twigs and lined with fine grass.

BAY-BREASTED WARBLER. *Dendroeca castanea*, Bd.

Resident of northern Vermont; puts nest high, and not easily found. One I have seen was built twenty-five feet from the ground on horizontal branch; coarse material outside, but lined with fine moss in a very artistic manner.

CHESTNUT-SIDED WARBLER. *Dendroeca Pennsylvanica*, Bd.

A common summer resident. Nest coarser than the yellow bird; built of grass lined with fine straws and hair; build on shrubs from four to six feet from the ground. Eggs purple.

BLACK-AND-YELLOW WARBLER. *Dendroeca maculosa*, Bd.

One of the most elegant of the family. Builds a beautiful nest interlaced with twigs and grasses, and I think always lined with black horse hair; why other colors are not desirable seems a peculiarity.

CAPE MAY WARBLER. *Dendroeca tigrina*, Bd.

Rare. Builds in low thick spruces, about five feet from ground. Nest similar to above, only not particular about hairs.

YELLOW-THROATED WARBLER. *Dendroeca dominica*, Bd.

Very rare. Shot one in Lunenburgh in 1878. Never saw its nest in the state.

YELLOW RED-POLL WARBLER. *Dendroeca palmarum*, Bd.

This bird comes to us in early spring; nests on the ground, and haunts plowed fields and roadsides often in company with sparrows. Breeds, I think, only in northern part of the state.

PINE-CREEPING WARBLER. *Dendroeca pinus*, Bd.

This is a plain bird, larger than other warblers, and comes to us early, sometimes in March. They are found in the spruce and pine woods.

Golden-crowned Accentor; Oven Bird. *Siurus auricapillus*, Sw.

This peculiar nest builder that gives it its name from roofing over its nest is not common, yet is often seen in southern part of the state.

New York Accentor; Water Thrush. *Siurus nœvius*, Coues.

This bird is found in all suitable places. Is a summer resident of our swamps, especially of the sphagnous variety. Its nest is on the ground and built of mosses, lined with slender rootlets.

Maryland Yellow-throat. *Geothlypis trichas*, Cab.

Any bush in Vermont may contain one of those jubilant little birds, with the nest near at hand at foot of bush or tussock, and sometimes partly roofed over, made with dry leaves, grasses, etc., lined with fine fibers or hair.

Yellow-breasted Chat. *Icteria virens*, Bd.

Very rare. Nest in bush some three feet from ground, built of leaves, dried grass, bark, etc., lined with fine fibers of same material.

Green black-capped Warbler. *Wilsonia pusilla*, Bp.

In northern Vermont as a variety, in winter.

Canadian flycatching Warbler. *Wilsonia Canadensis*, Coues.

A common summer resident. Builds on ground under tuft of grass; builds of the needles of spruce or pine.

Redstart. *Setophaga ruticilla*, Sw.

A summer resident. One of the most active of the flycatchers. Builds nest in fork of a sapling, from five to twenty feet from ground.

FAMILY TANAGRIDÆ.—Tanagers.

Scarlet Tanager. *Pyranga rubra*, V.

One of our most brilliant summer residents. Builds its nest in groves, and even in our orchards, of strips of bark, rootlets, twigs and leaves, nicely lined with materials of some kind.

FAMILY HIRUNDINIDÆ.—Swallows.

American Barn Swallow. *Hirundo erythrogastra horreorum*, Coues.

Too common and well-known to need comment.

White-bellied Swallow. *Iridoprocne bicolor*, Coues.

Often accept boxes put up for them, and yet build in stumps and natural holes in trees, etc. Do not use mud, but build of dried grass lined with feathers.

Cliff, or Eave Swallow. *Petrochelidon lunifrons*, Cab.

Build under eaves of buildings when there is a little ledge to hold nests, otherwise on hard banks, or perpendicular face of rock; common.

BANK SWALLOW. *Cotile riparia.* Boie.

Make excavations in banks for nests, and congregates in hundreds on favorable location.

PURPLE MARTIN. *Progne subis*, Bd.

A common bird, nesting usually only where man gives them the accommodation of a little house to build in. Will not allow hawks or crows to come within one-fourth mile of their abodes; are beligerent, and chatter with great vehemence in early morning.

FAMILY AMPELIDÆ.—WAXWINGS.

BOHEMIAN WAXWING. *Ampelis garrulus.*

Occasionally seen in southern Vermont.

CAROLINA WAXWING, CEDAR BIRD, CHERRY BIRD. *Ampelis cedrorum*, Gray.

One of our most beautiful and abundant birds. Build their nests in cedars and sometimes in our orchards. Are very destructive to cherries. They build their nests of the most convenient materials at hand, using an abundance of it.

FAMILY VIREONIDÆ.—GREENLETS.

RED-EYED GREENLET. *Vireo olivaceus*, V.

A sylvan bird of the forest, yet are seen about orchards. Build cup-like pensile nests, and lay white, fine specked eggs.

BROTHERLY LOVE GREENLET. *Vireo Philadelphicus*, Cass.

Very rare in this state.

WARBLING GREENLET. *Vireo gilvus*, Bp.

Common bird about shade trees, especially elms. Nests high up, but pensile, and does not specially differ from other vireos.

YELLOW-THROATED GREENLET. *Vireo flavifrons*, V.

Not common. Its nest is peculiar, being adorned with stucco work of lichens, like the humming bird's.

BLUE-HEADED GREENLET. *Vireo solitarius*, V.

Not common. Nest like the yellow-throated Greenlet.

WHITE-EYED GREENLET. *Vireo noveboracensis*, Bp.

Very rare. Have never seen its nest.

FAMILY LANIIDÆ.—SHRIKES.

GREAT NORTHERN SHRIKE, OR BUTCHER BIRD. *Lanius borealis*, V.

This bold brigand is only too common, and yet fitful in his appearance, only coming now and then in any special locality. Has been known to breed in northern Vermont, but not commonly.

LOGGERHEAD SHRIKE. *Lanius ludovicianus.*

Very rare, but has been killed in the State.

WHITE-RUMPED LOGGERHEAD SHRIKE. *Lanius ludovicianus excubitorides*, Coues.

A rare visitant.

FAMILY FRINGILLIDÆ.—FINCHES.

PINE GROSBEAK. *Pinicola enucleator*, Cab.

A resident of northern Vermont, and found now and then almost anywhere. Are liable to drift about in flocks from place to place, yet their home is in the evergreen forest.

PURPLE GROSBEAK. *Carpodacus purpureus*, Gray.

This bird may be found at all seasons, but more abundant in summer, but is not often seen.

WHITE-WINGED CROSSBILL. *Loxia leucoptera*, Gm.

Quite abundant, especially in winter. It breeds while snow is on the ground. More abundant in pine woods.

AMERICAN RED CROBSBILL. *Loxia currirostra Americana*, Coues.

Nests in Vermont and are much more abundant than the white winged, though they are often seen together.

RED-POLL LINNET. *Ægiothus linaria*, Cab.

A migrant and winter visitor.

AMERICAN MEALY RED-POLL. *Ægiothus exilipes*, Coues.

Seen occasionally in winter.

AMERICAN GOLDFINCH; THISTLE-BIRD; YELLOW-BIRD. *Astragalinus tristis*, Cab.

One of our familiar birds, gay colors, sweet songs, agreeable presence and engaging habits. Regarded with favor everywhere. Nests in trees at all heights, from six feet, upwards. Nest resembles the summer warbler.

SNOW BUNTING; SNOWFLAKE. *Plectrophanes nivalis*, Mey.

Coming with the snow storms, they do not leave us until April, and are seen in flocks around our villages and farm homes.

LAPLAND LONGSPUR. *Centrophanes lapponicus*, Kaup.

Habits, and sojourn with us like the Snow Bunting.

SAVANNA SPARROW. *Passerculus savana*, Bp.

One of the common birds of Vermont, sometimes being absent but a short time. Is generally called the ground bird, as it is seldom off the ground and nests there.

BAY-WINGED BUNTING; GRASS FINCH. *Pooecetes gramineus*, Bd.

This is another ground nester, but is a fine songster along our roadsides.

Yellow-winged Sparrow. *Coturniculus passerinus*, Bp.

Has been seen in southern part of state. but very rarely.

Henslow's yellow-winged Sparrow. *Copurniculus Henslowi*, Bp.

A rare summer resident.

Swamp Sparrow. *Melospiza palustris*, Bd.

Abundant in thick shrubbery. Nests on the ground. on or by a grass tussock. or in a small, low bush.

Song Sparrow. *Melospiza fasciata*, Sc.

An abundant summer resident. and the happiest and most cheerful of the sparrow family. Nests in a bush close to the ground, the nest being ordinary; as we cannot expect one bird to possess all the graces.

Black Snow-bird. *Junco hiemalis*, Scl.

When boys see this bird about their homes in winter, when there is so little bird life around, his love for natural history increases, and while he feeds some, he is quite likely to try his capabilities of preserving one of those specimens. and so this snow bird is on the mantles of many a home.

Tree Sparrow. *Spizella Monticola*, Bd.

A winter visitant, and yet a near relative of the familiar "Chippy."

Chipping Sparrow, or Hair Bird. *Spizella domestica*, Coues.

While spring may hesitate, you will be reminded of summer, by hearing from some bush the sound as though bits of flint were being chipped, by striking against each other. This is Chippy, that will build his neat horse hair nest in some convenient bush near your very door.

Field Sparrow. *Spizella agrestis*, Coues.

This is a common bird in field and pasture, and puts her nest on the ground at the root of a small bush if convenient. Is a familiar bird, with clear notes that make a sweet morning or evening song.

White-throated Sparrow: Peabody bird. *Zonotrichia albicollis*, Bp.

A large, handsome sparrow, and a fine song; a few remain all the year with us, especially in southern part of state; nest on ground.

White-crowned Sparrow. *Zonotrichia leucophrys*, Sw.

Irregular in appearance; not common. Size not inferior to the last. Nests about three and one-half feet from ground, with nest as large as a robin. Built of grasses; lined smoothly inside.

Fox Sparrow. *Passerella iliaca*, Sw.

A migratory bird seen spring and fall.

INDIGO BIRD. *Passerina cyanea*, Gr.

An attractive bird of vivacious manners, but not very brilliant song. Builds nest in bushes within a foot or two of the ground; rather slovenly, and of the most convenient material.

BLUE GROSBEAK. *Guiraca cœrulea*, Sw.

A rare bird, yet occasionally seen here.

ROSE-BREASTED GROSBEAK. *Zamelodia ludoviciana*, Coues.

This elegant bird famous for beauty of song and plumage, is often among us, and yet not every year in equal numbers. A deep woods' bird and yet nests on the outskirts, in saplings, but high from the ground. A large nest of convenient material.

TOWHEE BUNTING. *Pipilo erythrophthalmus*, V.

By some called "Marsh robin." Is often seen, but not plenty.

THE HOUSE SPARROW. *Passer domesticus.*

Brought from England, and domesticated. Feeds upon insects and seeds and grain. Many dislike him, but there are things in his favor. It is so with most birds.

FAMILY ICTERIDÆ.—AMERICAN STARLINGS.

BOBOLINK; REED-BIRD; RICE-BIRD. *Dolichonyx oryzivorus*, Sw.

Is too prominent and well known to need a word. Is migratory, and change their plumage and song as well as name.

COW-BIRD. *Molothrus ater*, Gray.

A common bird, but a regular cheat, as the female lays her eggs in other bird's nests, thus causing them to be fostered by stepmothers that hatch and raise them.

RED-WINGED BLACK-BIRD. *Agelœus phœniceus*, V.

This bird is seen and known everywhere. Nest in reeds, bushes, or common grass near the ground. Not artistic; built of grasses and convenient material, with a few hairs for lining.

FIELD LARK. *Sturnella magna*, Sw.

Seen here, but not very common.

ORCHARD ORIOLE. *Icterus spurius*, Bp.

Increasing from year to year. Its nest is a marvel of skill, being a purse woven close and compact, sometimes of grass, sometimes of strings. It is perfectly pendant from a small branch.

BALTIMORE ORIOLE. *Icterus galbula*, Coues.

This is one of Vermont's beauties of bird life, called also the "Golden Robin," "The Fire Bird" or "Hang Nest." Nest similar to the orchard Oriole.

RUSTY GRACKLE. *Scolecophagus ferrugineus*, Sw.

Nests in Vermont, but not abundantly. Does not take pains to hide its nest, but builds on bushes, in out of way places, or in alders that overhang a brook. Builds of grasses and twigs mixed with mud.

PURPLE GRACKLE; CROW BLACKBIRD. *Quiscalus purpureus*, Licht.

A common bird in some parts of the state, yet hardly seen in others. Nests in a tree at almost any height. Nest loose and bulky.

FAMILY CORVIDÆ.—CROWS AND JAYS.

RAVEN. *Corvus corax.*

Very rare, but one has been killed to my knowledge, in the state.

COMMON CROW. *Corvus frugivorus*, Bartr.

The farmers' friend, eating many noxious insects, caterpillars, slugs, grubs, grasshoppers, &c. Yet he is so black, and has such an unstately walk, and no music in his voice, so he is generally hated.

BLUE JAY. *Cyanocitta cristata*, Strickl.

This bird is a vile robber, and almost the only bird that has no good thing about him.

CANADA JAY. *Perisoreus Canadensis*, Bp.

Often seen in northern Vermont, and breeds there now and then. "Whisky Jack" has few friends though not as mean as the Blue Jay.

FAMILY TYRANNIDÆ.—FLYCATCHERS.

KING BIRD; BEE-MARTIN. *Tyrannus Carolinensis*, Bd.

This tyrant is quite common and well known, as no birds make more noise than they. This whole tribe are exclusively insectiverous in food, and so must go and come with the insects on which they prey. Build their nests with substances most convenient and do not screen them from sight any more than the Robin.

GREAT CRESTED FLYCATCHER. *Myiarchus crinitus*, Cab.

Rather rare. Builds nests in the hollows of trees, post holes, and artificial retreats put up by man. Its nest may be known when found, for as far as I know, they always contain one or more of the cast off skins of snakes.

PEWEE; PEWIT; PHŒBE-BIRD. *Sayiornis fusca*, Bd.

A little tyrant, smart, but impatient, coming early yet never abundant in this state. Nests on crags, in roots of fallen trees or in banks. Nest is built like that of the barn swallow.

OLIVE-SIDED FLYCATCHER. *Contopus borealis*, Bd.

Not very common, but is a conspicuous bird by always perching at the end of a dead limb or some exposed situation. Nests high, shallow and not very nicely built, of convenient material.

WOOD PEWEE. *Contopus virens*, Cab.

A forest bird, quite plenty, but not much noticed.

ACADIAN FLYCATCHER. *Empidonax acadicus*, Bd.

Rarely seen in Vermont.

TRAILL'S FLYCATCHER. *Empidonax trailli*, Bd.

Rather rare in Vermont, yet has been taken at Bennington and Bethel, and in Connecticut River Valley.

LEAST FLYCATCHER. *Empidonax minimus*, Bd.

Most abundant of all flycatchers. Nests ten or twelve feet from ground; sometimes more or less. Nest placed in upright crotch, and built of fibrous inner bark and lined with vegetable down—a very pretty structure.

YELLOW-BELLIED FLYCATCHER. *Empidonax flaviventris*, Bd.

Breeds rarely in northern Vermont; usually further north. Rare.

FAMILY CAPRIMULGIDÆ.—WHIPPOORWILLS AND NIGHTHAWKS.

WHIPPOORWILL. *Antrostomus vociferus*, Bp.

Common summer resident. Nocturnal habits, and much oftener heard than seen. Nests usually on the ground in just a little hollow made by pushing the leaves, &c., out of the way. Lays but two eggs.

NIGHT-HAWK OR BULL-BAT. *Chordediles popetue*, Bd.

Very common. Feeds in dusk of evening, and is peculiar in its movements. Its habits well known.

FAMILY CYPSELIDÆ.—SWIFTS.

CHIMNEY SWIFT. *Chætura pelasgica*, Steph.

A common bird, often called swallows. Used to build in hollow trees, but, since the country was settled, in chimneys. They not only nest there, but often live there in hundreds.

FAMILY TROCHILIDÆ.—HUMMING BIRDS.

RUBY-THROATED HUMMING BIRD. *Trochilus colubris*.

This beautiful little brilliant bird builds its nest with vegetable down, and sticks it all over outside with lichens off the tree it builds on, so it looks like an old knot. The imitation is so perfect that it is not often found. Those I have seen were in apple trees.

FAMILY ALCEDINIDÆ.—Kingfishers.

Belted Kingfisher. *Ceryle alcyon*, Boie.

Lives on fish and vomits the bones in a hole in a bank, and calls it its nest. It is putrid and full of vermin, and yet it answers their purpose. and in such a place their young are reared.

FAMILY CUCULIDÆ.—Cuckoos.

Black-billed Cuckoo. *Coccygus Erythrophthalmus*, Bd.

Most numerous of the two species that inhabit the state, yet never very abundant. They sometimes drop their eggs in other birds' nests, yet often rear their own brood. They lay eggs only at intervals of several days, so the first hatched birds help hatch others.

Yellow-billed Cuckoo. *Coccygus Americanus*, Bd.

Traits and habits as last described.

FAMILY PICIDÆ.—Woodpeckers.

Pileated Woodpecker. *Hylotomus pileatus*, Bd.

Wild, solitary bird, yet sought by the amateur naturalist, as his head is so red and his body so large that he is always conspicuous.

Hairy Woodpecker. *Picus villosus.*

Found everwhere but not abundant in the State. Nest in very secluded places.

Downy Woodpecker. *Picus pubescens.*

The ring of holes drilled around an apple or a pear tree, when in perfect health, is the work of this little mischief. Some say he drills these for sap, and others, for the insects that collect about them, but it looks like pure mischief. They, however, chisel a hole for their nest in some dead tree with great labor.

Black-backed three-toed Woodpecker. *Picoides arcticus*, Gr.

Almost the only three-toed bird. A permanent resident.

Yellow-bellied Woodpecker. *Sphyropicus varius*, Bd.

This is a very different kind of woodpecker, as they take much of their food on the wing instead of out of holes in trees. Its tongue is not the spear of other varieties, and not capable of such extension. Chiefly observed in spring and fall.

Red-headed Woodpecker. *Melanerpes erythrocephalus*, Sw.

The "red, white and blue" of this bird is too well known to need comment.

Golden-winged Woodpecker; Flicker. *Colaptes auratus*, Sw.

The most common of all the tribes, and has a half dozen, at least, local names not here given.

FAMILY STRIGIDÆ.—Owls.

Barn Owl. *Aluco flammeus pratincola*, Coues.

Found in northern Vermont and thought to breed there, yet that part is uncertain. Eggs were brought me larger than doves' and speckled, said to be the eggs of the owl, and the owls were brought also. The owls are right, and the eggs not yet identified.

Great-horned Owl. *Bubo Virginianus*, Bp.

Common. Nest I have never found.

Screech Owl; Red or Mottled Owl. *Scops asio*, Bp.

Very common. Nests in hollow trees, and builds of sticks, leaves and feathers. Is a great mouser, one owl being as good as six cats.

Long-eared Owl. *Asio Wilsonianus*, Coues.

Often met with. Nests in thick evergreen trees, often appropriating a crow's nest.

Short-eared Owl. *Asio accipitrinus*, Newt.

Common. Frequents marshy places. Is a persistent hunter of shrews and field mice. Nests on the ground, and builds but little, of sticks and coarse material.

Great Gray Owl. *Strix cinerea*, Gm.

Frequently met with in northern Vermont. Usually in winter. Does not nest here.

Barred Owl. *Strix nebulosa*, Forst.

A resident often seen, but seems to decrease with cutting off the forest. Nests in hollow trees. Lives on small quadrupeds.

Snowy Owl. *Nyctea scandiaca*, Newt.

A winter visitor; sometimes in great numbers.

Hawk Owl; Day Owl. *Surnia funerea*, Rich and Sw.

Is a permanent resident in northern part of state. Nests in trees; builds of sticks lined with hay or grass, yet sometimes with moss also.

Richardson's Owl. *Nyctala tengmalmi, Richardsoni*, Ridg.

Occasional, but not common; winter visitor. Do not think it nests with us.

Saw-whet or Acadian Owl. *Nyctala Acadica*, Bp.

Quite common, seeming to like the vicinity of buildings. Have trees about my house of different varieties, and it often comes among them in winter or spring, and sometimes in early summer. Nests in hollow trees. Owls are all beneficial to man, as they destroy thousands of pests.

FAMILY FALCONIDÆ.—Hawks.

Marsh Hawk or Harrier. *Circus cyaneus. Hudsonius*, Schl.

Common in spring and summer, and may be seen flying low, search out mice, frogs and such small game in wet places. Male and female very unlike, and sometimes called different species.

Swallow-tailed Kite. *Elanoides forficatus*, Coues.

Very rarely found.

Sharp-shinned Hawk. *Accipiter fuscus*, Bp.

A common hawk, and a spirited and dashing bird. It nests in trees and on rocks, and a late breeder.

Cooper's Hawk; Chicken Hawk. *Accipiter cooperi*, Bp.

One of the most abundant of the family. Nests in trees.

American Goshawk. *Astur atricapillus*, Bp.

A winter visitant, and a few remain through the summer and nest here.

Gyrfalcons or Jerfalcons. *Falco gyrfalco.*

Occasional, but rare.

Duck Hawk; Peregrine Falcon. *Falco peregrinus*, Tunstall.

A resident. In Brandon, it is said, a pair have bred regularly for twenty-five years. They seem attached to their location, as a home.

Pigeon Falcon, Pigeon Hawk. *Falco Columbarius.*

A summer resident, and very common.

Rusty-crowned Falcon; Sparrow Hawk. *Falco sparverius.*

Resident, and a pest to small birds. Easily domesticated, and becomes quite tame. Often seen in cages.

Red-tailed Buzzard; Hen Hawk. *Buteo borealis*, Gm.

Permanent resident. Nests in high trees; builds of twigs, grass, moss, etc.

Red-shouldered Buzzard; Winter Hawk. *Buteo lineatus*, Jard.

The most abundant of the large hawks, and a resident; nest is smaller and placed out on a branch instead of near the tree as the Red-tailed Buzzard does.

Broad-Winged Buzzard. *Buteo Pennsylvanicus*, Bp.

Not common, but seen now and then. Breeds in the state.

Rough-legged Buzzard. *Archibuteo lagopus sanct-johannis*, Ridg.

Found in marshes. Feeds on mice and reptiles. Nests in trees or on cliffs. Rare.

Osprey; Fish Hawk. *Pandion haliaetus*, Sav.

Common about ponds and streams in autumn. Never saw a nest in the state.

GOLDEN EAGLE. *Aquila chrysætus*, Cuv.

Abundant about the woods and mountains; Nest very large, and placed on crags or trees near rocks, with partially dead, thick tops. Is said to lay but two eggs, but have seen three, and had, apparently, authentic accounts of four. Is decreasing as timber is cut off.

BALD EAGLE. *Haliætus leucocephalus*, Sav.

Often seen, and yet not as plentiful as formerly. Commonly nests in a large tree, but not always; uses sticks two inches in diameter to begin with, and carries up a large amount of material.

FAMILY CATHARTIDÆ.—AMERICAN VULTURE.

TURKEY BUZZARD. *Cathartes aura*, Ill.

Not often seen in Vermont, yet have known one capture, so it comes here.

CARRION CROW. *Catharista atrata*, Less.

Of rare occurrence. Never known of its being taken here.

FAMILY COLUMBIDÆ.—PIGEONS.

PASSENGER PIGEON; WILD PIGEON. *Ectopistes migratorius*, Sw.

A remnant of the countless numbers of past time only remain.

FAMILY TETRAONIDÆ.—GROUSE.

CANADA GROUSE, OR SPRUCE PARTRIDGE. *Canace Canadensis*, Reich.

Common in the big woods of Essex County, but they decrease as the timber is cut away. Nests on the ground. Is not much afraid of man.

RUFFLED GROUSE, OR PARTRIDGE. *Bonasa umbella*, Steph.

Common, and yet not as numerous as formerly.

THE AMERICAN PARTRIDGE, QUAIL, OR BOB-WHITE. *Ortyx Virginiana*, Bp.

Occasional only.

WATER BIRDS.

FAMILY CHARADRIDÆ.—PLOVERS.

BLACK-BELLIED PLOVER. *Squatarola helvetica*, Cuv.

A migrant, sometimes seen in flocks.

GOLDEN PLOVER. *Charadrius dominicus*, Mull.

Sometimes, but rarely seen. Does not breed here.

KILDEER PLOVER. *Aegialites vociferus*, Bp.

Not common, but said to nest in the state.

SEMIPALMATED RING PLOVER, RING-NECK. *Aegialites semipalmatus*, Cab.

Have seen it about Groton pond in considerable numbers, but nowhere else, yet it is doubtless found in many places in the state.

FAMILY SCOLOPACIDÆ.—SNIPE, ETC.

THE WOODCOCK. *Philohela minor*, Gr.

Occasionally seen; not common.

THE AMERICAN SNIPE; WILSON'S SNIPE. *Gallinago Wilsoni*, Bp.

Said to be seen here, but am not certain about it.

RED-BREASTED SNIPE; GRAY SNIPE; BROWN-BACK; DOWITCHER. *Macrorhamphus griseus*, Leach.

Said to come to Memphremagog Lake in flocks, but have not seen them, and am not sure of its identity.

PECTORAL SANDPIPER; GRASS SNIPE; JACK SNIPE. *Actodromas maculata*, Coues.

Migrant, commonly seen in autumn.

PURPLE SANDPIPER. *Arquatella maritima*, Bd.

Occasionally breeds in Vermont, as I had the old bird with young brought me a few years since.

GREATER TATTLER; GREATER YELLOW LEGS; STONE SNIPE. *Totanus melanoleucus*, Vieill.

Rarely seen in small flocks in autumn.

SOLITARY TATTLER; AMERICAN GREEN SANDPIPER. *Rhyacophilus solitarius*, Bp.

Rarely seen; a migrant generally, but few are said to nest here.

SPOTTED SANDPIPER. *Tringoides macularius*, Gray.

Nests in the state.

BARTRAMIAN SANDPIPER; UPLAND PLOVER. *Bartramia longicauda*, Coues.

Sometimes abundant in fall.

BUFF-BREASTED SANDPIPER. *Tryngites rufescens*, Cab.

Rare, yet a few have been killed and sent me during the last ten years.

FAMILY ARDEIDÆ.—HERONS.

GREAT BLUE HERON. *Ardea herodias*, Linn.

A common summer resident in Vermont. Nest in trees, in swamps, coarsely built.

GREEN HERON. *Butorides virescens*, Cab.

One was shot in Lunenburgh, on the Connecticut River, and is now in cabinet. Have never known of others.

NIGHT HERON ; QUA-BIRD ; SQUAWK. *Nyctiardea grisea nævia*, Allen.

Common summer resident. Nests in trees, and all in a township seem to desire to nest in the same tree.

AMERICAN BITTERN. *Botaurus mugitans*, Coues.

Rarely seen in Vermont.

LEAST BITTERN. *Ardetta exilis*, Gr.

Scarce.

FAMILY GRUIDÆ.—CRANES.

GREAT WHITE, OR WHOOPING CRANE. *Grus Americana* Temm.

Scarce, more so than formerly.

BROWN, OR SAND-HILL CRANE. *Grus pratensis*, Bartr.

One captured two years ago on the Connecticut at Lunenburgh. Scarce.

FAMILY RALLIDÆ.—RAILS AND THEIR ALLIES.

VIRGINIA RAIL. *Rallus Virginianus*, Linn.

Very rare.

CAROLINA RAIL, OR SORA. *Porzana Carolina*, Vieill.

More common, but not abundant.

YELLOW RAIL, OR CRAKE. *Porzana noveboracensis*, Cass.

Specimen shot at Newport. Never saw any other here, yet said to be seen now and then.

FLORIDA GALLINULE. *Gallinula galeata*, Bp.

One specimen shot on Lake Champlain. Said to be often seen there.

FAMILY ANATIDÆ.—SWANS, GEESE and DUCKS.

COMMON WILD GOOSE ; CANADA GOOSE. *Bernicla Canadensis*, Boie.

Seen spring and fall. Seldom breed here.

DUSKY DUCK. *Anas obscura*, Gm.

Breed with us often, but mostly further north.

GREEN-WINGED TEEL. *Querquedula Carolinensis*, Steph.

Migratory. Seen in transit.

SUMMER, or WOOD DUCK. *Aix sponsa*, Boie.

Quite common. Nest in holes in trees and rock cavities. A beautiful bird.

MERGANSER; GOOSANDER; FISH DUCK. *Mergus merganser.*

Not common, but breed at Groton Pond, and said to at Memphremagog.

HOODED MERGANSER. *Mergus cucullatus.*

Rare. Builds nest in old trees or stumps.

FAMILY PHALACROCORACIDÆ.—CORMORANTS.

COMMON CORMORANT. *Phalacrocorax carbo*, Leach.

One shot four years ago on the Connecticut, at Lunenburgh. Supposed he was driven inland in a storm, as it was just after a violent easterly gale.

FAMILY LARIDÆ.—JAEGERS; GULLS; TERNS AND SKIMMERS.

GLAUCOUS GULL, OR BURGOMASTER. *Larus glaucus*, Brunn.

One shot on Maidstone meadows by Dr. Dodge; the only one, as far as I know, ever seen in Vermont.

BONAPARTE'S GULL. *Chroicocephalus Philadelphia*, Lawr.

Specimen in cabinet shot at Newport. Not common.

FAMILY COLYMBIDÆ.—LOONS.

GREAT NORTHERN DIVER, OR LOON. *Colymbus torquatus*, Brunn.

Common; breeds here; nests on ground.

FAMILY ALCIDÆ.—AUKS.

SEA DOVE; LITTLE AUK, OR DOVEKIE. *Alle nigricans*, Link.

In 1874, after a severe easterly storm of snow, many were found in New Hampshire and Vermont, and killed; rarely one is so killed now. Suppose they were blown inland in the storm, having lost their way.

FORESTRY.

A Lecture by Dr. Hiram A. Cutting.

What a noble gift to man are the forests! What a debt of gratitude and admiration we owe for their utility and their beauty! How pleasantly the shadows of the wood fall upon our heads when we turn from the glitter and turmoil of the world of man! The winds of heaven seem to linger amid their balmy branches, and the sunshine falls like a blessing upon the green leaves; the wild breath of the forest, fragrant with its hundred perfumes, fans the brow with greatful freshness, and its beautiful mellow woodlight, full of calm and peaceful influences, gives a repose to the spirit of man not found elsewhere. Let us cherish the forest; first, because it is beautiful, and beauty everywhere gives happiness; and, second, because it is of utility beyond even our conception or belief.

Allow me, also, to appeal for aid to the cultivated and refined sensibilities of the ladies. In the forest's sheltering shade and the rich mold of their annually decaying leaves, the greater number of our loveliest plants are found; and when the axe comes, that cruel weapon that wars upon nature's freshness, and the stately pine, the spruce, the noble oak, the elm, the beech and the maple fall with a loud crash in the peaceful solitude, even the very birds can understand that a floral death-knell sounds through the melodious wilderness.

A number of our choicest plants are threatened with extinction; for as the woods are cleared away, these tender offsprings, the pretty flowers, which we so dearly cherish, will perish utterly. It is, therefore, well to prevent, as far as possible, the destruction of our native forests, as well as to plant forest trees, if for no other purpose than the preservation of the little helpless, blooming beauties that adorn our woodland shades.

But this preservation means much more. Yes, even to Vermont, they are a necessity. Without our forests our land would be desolate. Our springs and wells would all fail in the summer, our mill streams would be nearly or quite dry, and our rivers changed to rivulets. The soil, being exposed, would sooner dry up after rain, and if it be clay, it would become hard so that when the rain came it would run off at once, instead of sinking into the earth. The water, no longer obstructed by roots and rubbish, would not trickle slowly as now into the water courses, but upon steep mountain slopes and hillsides would bare the rocks of earth, which would come down the ravines with the water, making them immense chasms, and the rocks and rubbish carried down by those torrents would cover the fertile valleys below with stones and gravel, and spreading over the plains in destructive inundations, would desolate the country far and wide.

You may say this is an overdrawn picture, but the half is not yet told. A forest *does* cause rain to fall, or at least it does not, as does

the open plain, prevent rain from falling. This meteorological influence of the forest is due to the moist condition of the air column above the forests, which tends to saturate any clouds moving through this area, thus facilitating precipitation, whilst the heated air over the plain tends to increase the relative capacity of an air column for moisture, therefore decreasing the chance for discharge. Hence the clearing off of all forests means desolation.

But you say we have plenty remaining. Yet in how many places is the forest which once lent us shade, nothing more than a memory! The grave and noble circle which adorned the mountain is every day contracting. Where you come in the hope of seeing life, you find but the image of death. O, who will really undertake the defense of the trees, and rescue them from senseless destruction? Who will eloquently set forth their manifold mission, and their active and incessant assistance in the regulation of the laws which rule our globe? Without them, it seems delivered over to blind destiny, which will involve it again in chaos! The motive powers and purificators of the atmosphere through the respiration of their foliage, avaricious collectors to the advantage of future ages of the solar heat, it is they which pacify the storm and avert its most disastrous consequences. They render marshes healthful, wet soils are made comparatively dry, on the abrupt declivities, they consolidate the crumbling soil, check and break the torrent, control the melting of the snows, and preserve to the meadows the fertile humidity which in due time will overspread them with a bounteous harvest.

Is not this enough. To watch over the life of the tree and its general harmony, is it not to watch over the safety of humanity? And to aid us in our toil, by cheering thoughts, let us think that our coal fields, where are stored up the wealth of the plants of ages past, give us our steam power, and that gives us this wonderful age of scientific advancement. But for timber, wood and the coal, which is the product of woody growth, we should be barbarians. Yes, worse than that if possible, for if we had an existence at all, it would be a low groveling one like unto the animal life first upon the globe, because our atmosphere could not nourish high intellectual powers, unless vegetation first purified it.

That we may see what man has done in his acts of vandalism, allow me to give a few extracts from eminent observers to verify what I have said, as I wish to wake up the people of Vermont to the value of their forests, and to prevent the fulfillment of the prediction of Bryant's Indian at the burial-place of his fathers:

"But I behold a fearful sign,
To which the white man's eyes are blind.
Before these fields were shorn and tilled,
Full to the brim our rivers flowed,
The melody of waters filled
The fresh and boundless wood.
And torrents dashed and rivulets played,
And fountains sported in the shade.
These grateful sounds are heard no more,
The springs are silent in the sun,
The rivers, by the blackened shore,
With lessening currents run;
The realm our tribes are crushed to get
May be a barren desert yet."

PALESTINE.

Rothe says, at the time when Joshua conquered the Promised Land, milk and honey were flowing in Canaan; that is, it was a country of wonderful fertility, blessed with a delightful climate. Both ranges of the Lebanon and its Spur Mountains were then densely covered with forests, in which the famous cedar predominated, that stately tree so masterly and poetically described by the psalmist and the prophets. The large and continually increasing population of Palestine enjoyed comfort and abundance during centuries. But the gradual devastation of the forests, which was finally completed by the Venetians and the Genoese, brought about a general deterioration of the country. The hills of Galilee, once the rich pasturing grounds for large herds of cattle, are now sterile knobs. The Jordan became an insignificant stream, and the several beautiful smaller rivers, mentioned in the Bible, now appear as stony runs, leading off the snow and rainwater, but being completely dry during the greater part of the year. Some few valleys, in which the fertile soil washed down from the hills, was deposited, have retained their old fertility, but the few cedar trees remaining as a landmark around the Maronite convent on the rocky and barren Lebanon, look lonely and mournfully upon an arid and desolate country, not fit to sustain one-sixth of such a population as it contained at the time of Solomon.

SPAIN.

Under the reign of the Moorish caliphs the Iberian peninsula resembled a vast garden, yielding grain and fruit of every known variety, in the most perfect quality, and in endless abundance, and thickly populated by a highly cultivated people. But then the sierras and mountain slopes were covered with a luxuriant growth of timber, which was afterwards wantonly destroyed under the rule of the kings. Large herds of half-wild goats and sheep prevented the spontaneous growth of trees on the neglected lands. Now nearly all the plateau lands of Spain, being fully one-third of the entire area, are desert-like and unfit for agriculture, because of the scarcity of rain and the want of water. Another one-third of the territory is covered with worthless shrubs and thorn-bushes, and affords a scanty pasture for the merino sheep, the number of which is decreasing from year to year. The once delicious climate has become changeable and rough, since there are no more forests to break the power of the scorching Salano and the cold Galego wind. The average depth of the fine rivers that cross Spain in all directions has greatly diminished. The government, well aware of the causes of the deterioration of the soil and climate, has lately made earnest efforts, partly to replant the old forest grounds, but has met with little success, it being very difficult to make trees grow on former timber land, which has been lying waste for a long time. It will take a full century's time and necessitate an immense outlay of money to restock Spain with sufficient timber.

THE EASTERN COAST OF THE ADRIATIC SEA.

On the entire coast of the Adriatic Sea, in Dalmatia, Herzegovina, and Montenegro, the same evil consequences of the devastation of the natural forests are clearly perceptible. These coast lands were very fertile until the Romans, having used up their own timber, took it from the other side of the Adriatic, until millions of Illyric trees were converted into pillars and rammed into the lagunas to make foundations for the houses, palaces, and churches of Venice. What was left by the lumbermen was destroyed by the camp-fires of careless herdsmen, and here also the goats did their pernicious work in preventing spontaneous growth. The long mountain range running along the coast, which was yet well timbered in the time of the great Constantine, is now destitute of all soil; the naked lime-roads, reflecting the hot rays of the sun, warn the stranger not to enter the sterile and inhospitable country, hardly worth the loss of human life and treasure which the subjection of its unruly inhabitants now costs the house of Hapsburg.

SICILY.

Let us look at Sicily, once the great grain reservoir for Rome. Since the island of plenty was despoiled of its forests, it has gradually lost its fertility and the mildness of its climate. The ruins of proud and opulent Syracuse lie in a desert, covered by sand, which the hot sirocco carried over the Mediterranean Sea from Africa. A few isolated, well-watered, and carefully cultivated districts of very limited extension, is all that is left to remind the tourist of the by-gone glory of Sicily.

PYRENEES MOUNTAINS.

The desolation of mountain regions by the clearing of forests is strikingly illustrated in the Pyrenees. Formerly the plains were cultivated, and inundations were much less frequent and less destructive than nowadays. As roads came to be opened, the profit from sheep and cattle became greater, and the clearing of forests was begun to make room for pasturage and, to some extent, for timber, until by degrees the slopes of the mountains were denuded, and the rains, having nothing to hinder, began to form eroding torrents, the south slopes suffering most, because first cleared and directly exposed to the sun's heat. The extremes of flood and drouth became excessive, and extensive tracts have been ruined for present occupation from this source.

ITALY.

When the Apennine and Sabinian mountain range and its slopes were covered with its natural growth of trees, the now detested Roman Campagnas, which constitute the largest part of the Pontine swamps, were a beautiful section of country. They were then adorned with sumptuous

summer residences, villas, parks, flower and fruit gardens of the Roman aristocrats. After the destruction of the forests, the whole region became unhealthy, and almost absolutely uninhabitable on account of the malarious gases emanating from the soil. Formerly, these were absorbed by the leaves of numerous trees; now they fill the air and infect even the very heart of St. Peters's eternal city.

R. W. Phipps of Toronto, in his admirable report, says: "That within a few years a portion of these swamps have been planted with eucalyptus trees, and they have had a wonderful effect on the healthfulness of the atmosphere, and people now reside in these parts during the summer, where but a short time ago it was impossible to live. The eucalyptus tree is now being introduced into the everglades of Florida in order to purify the air in these unhealthy regions of the state."

ISLAND OF ASCENSION.

The Island of Ascension furnishes another remarkable instance. This island, some seven and a half miles long and six wide, was entirely barren when first occupied in 1815, and so destitute of water that supplies were brought from England and the Cape of Good Hope. Means have since been taken to plant trees and to introduce agriculture on the island, though not to any great extent. The effect has been remarkable. The island grows forty kinds of trees where but one grew in 1843, owing to want of water. The water supply is excellent, and the garrison and ships visiting the Island are supplied in abundance with vegetables of various kinds.

CEYLON.

In his report to the Earl of Kimberly, Dr. J. D. Hooker, of the Royal Kew Gardens, says: "The presence of forests plays a most important part in storing the rainfall and yielding up gradually to the streams a continuous supply of water, a thing, I need hardly say, in a hot country of primary importance. Moreover, the rain is retained by forests on the surface of the ground; it gradually permeates to the subsoil, and so feeds the underground water-bearing strata upon which springs and wells must eventually depend. If the forest is indiscriminately removed, the rain runs off as it falls, and washes away the supercificial and fertile soil with it. The mischief already done in Mauritius and various West India Islands is so widely spread (being in some, indeed, irreparable), that I venture to press upon your lordship my own opinion as to the urgency of active steps being taken in the case of an island so beautifnl and at present so fertile as Ceylon. I have lately received an account of the deterioration of the climate of some of the Leeward Islands, which affords a melancholy confirmation of what I have urged above. The contrast between neighboring islands similarly situated is most striking. The sad change which has befallen the smaller ones is due to human agency alone. It is reported of these that in former times they were clothed with dense forests, and their older inhabitants remembered when the rains were

abundant and the hills and all uncultivated places were shaded by extensive groves. The removal of the tree is the cause of the present evil. The opening of the soil to the vertical sun rapidly dries up the moisture. Without shade upon the surface, the water is rapidly exhaled, and springs and streams are dried up."

ISLAND OF SANTA CRUZ.

The famous West Indian island of Santa Cruz is at present suffering from the vandalism of its inhabitants; its eastern portion, which twenty-seven years since was rich, populous, and of tropical luxuriance, now deprived of its forests, has become dry, arid, and worthless. It is found to be too late to retrieve the previous error, for, of a thousand trees recently planted upon an estate on this island, not one survived. The facts in regard to the island of Curacoa are still more interesting: "In the year 1845 it was found to be an almost perfect desert. Where, according to the testimony of the inhabitants, had once been a garden of fertility, abandoned plantations, the recent ruins of beautiful villas and terraced gardens, and broad arid wastes, without a blade of grass, showed how sudden and complete a destruction had fallen upon this unfortunate little island. The cause was the cutting-down of the trees for export of their valuable timber; the effect followed even more rapidly than at Santa Cruz, as the island lies five leagues further south, and the heat is more intense. The rains have almost entirely ceased. Almost within sight of Curacoa is the coast of the Spanish main, covered with the rankest vegetation, over which the burdened clouds shower down abundant blessings."*

ALGIERS, ST. JAGO ISLAND.

In Algiers marked changes in the climate have followed upon the deforesting of extensive tracts, and wonderful results have followed the systematic planting of other regions. The islands of the sea have been made so many isolated experimental stations, where men have learned how essential to health the forests are; while on some of them the conclusive test of reforesting has been made with a return of showers, and a more equable distribution of heat and cold. Saint Jago, the chief of the Cape de Verde Archipelago, was, at its discovery, clothed with a forest which has been recklessly destroyed. Rain is now lacking sometimes for a whole year; a green leaf can scarcely be detected over what were once fertile, lava plains, while certain of the harbors of the land have been filled up by the precious soil of the island, which has been carried down by the fierce torrents, which, alternating with drought, curse this naked land. Similar results have followed the destruction of forests on St. Helena, the Mauritius, and certain of the Canary Islands.

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*From Report of Commissioners of State Park, New York.

BUCHARIA.

Khanate of Bucharia presents a striking example of the consequences brought upon a country by clearings. Within a period of thirty years this was one of the most fertile regions of Central Asia, a country which, when well wooded and watered, was a terrestrial paradise. But within the last twenty-five years a mania of clearing seized upon the inhabitants, and all the great forests have been cut away, while the little that remained was ravished by fire during the civil war. The consequences were not long in following, and have transformed this country into a kind of arid desert. The water-courses are dried up and the irrigating canals empty. The moving sands of the desert being no longer restrained by barriers of forests are every day gaining upon the land, and will finish by transforming it into a desert as desolate as the solitudes that separate it from Khiva.

ISLAND OF TERNATE.

The effects of forests upon the general healthfulness of the state are great. The philosopher, Boyle, long since stated that in the Dutch East Indian island of Ternate, long celebrated for its beauty and healthfulness, the clove trees grew in such plenty as to render their product almost valueless. To raise the price of the commodity most of the spice forest was destroyed. Immediately the island—previously cool, healthy and pleasant—became hot, dry, and sickly, and unfit for human residence. It is well known that the general clearing away of the forests in this country has had a tendency to raise the temperature in summer.

OHIO.

Rothe asks, " If you have ever tried to find out why Southern Ohio has ceased to be the great fruit country *it was formerly known to be?* Why is it that we cannot raise any more peaches in our state, while they used to bring sure crops not more than a quarter of a century ago?" * * * * * What is it that makes this climate, once so favorable for mankind and vegetation, more unsteady from year to year? Look at the woodless hills of Southern Ohio, and you have the answer.

Let the hills be deprived of the rest of the protection which the forests afford, and half of the area of this state will be sterile in less than fifty years. The rain will wash the soil from the hilltops first, and then from the slopes; the limestone, which is now covered with productive humus, loam and clay, will be laid bare; the naked rocks will reflect the rays of the sun and increase the summer heat; the north storms will blow unhindered over the country, and every change of the wind will cause an abrupt change in the temperature. The rainfall will be diminished and become irregular. Melting snow and rainwater will at once run down in the valleys and cause periodical freshets, such as they never had until the immense mountain territory

was in part denuded, and the last two years furnished examples which will ultimately carry away the best part of the soil, even from the valleys. Such will be the unavoidable results of further devastation of timber.

KENTUCKY.

Hon. Cassius M. Clay of Kentucky said before the American Forestry Congress at Cincinnati: "I move in the sphere of experience with more certainty. I remember when the forests were hardly broken that springs of water were very frequent and perennial. The rivulets and creeks and rivers had a perpetual flow. These have now changed. The rivulets and creeks are now dried up in summer, and the fish so often caught by me in earlier years are gone. Not one spring in a thousand remains. Indian corn was generally planted in March, and the rains and exhalations of moisture from the surroundings made crops successful every year. Now the destruction of the forests has lost to us that bed of leaves which was a perpetual reservoir of water for springs and evaporation; aided by the treading of the hard surface, the rain-fall, if the same as of old, rushes off at once, sweeping the soil into the Mississippi delta. The dry winds absorb not only the ancient humidity of the air, but drink up the subsoil evaporation, so that our winters are longer, more changeable, and unendurable. Corn can hardly be safely planted till late in April, and drouth too often ruins all in spite of our best efforts."

MASSACHUSETTS.

Prof. Sargent of Harvard University, who has given this question as much study as any one in America, says: "As moderators of the extremes of heat and cold, the benefits derived from extensive forests are undoubted, and that our climate is gradually changing, through their destruction is apparent to the most casual observer. Our springs are later, our summers are drier, and every year becoming more so; our autumns are carried forward into winter, while our winter climate is subject to far greater changes of temperature than formerly. The total average of snowfall is perhaps as great as ever, but it is certainly less regular and covers the ground for a shorter period than formerly. Twenty years ago peaches were a profitable crop in Massachusetts; now we must depend on New Jersey and Delaware for our supply; and our apples and other orchard fruits now come from beyond the limits of New England. The failure of these and other crops in the older states is generally ascribed to the exhaustion of the soil; but with greater reason it can be referred to the destruction of the forests which sheltered us from the cold winds of the north and west, and which, keeping the soil under their shade cool in summer and warm in winter, acted at once as material barriers, and reservoirs of moisture."

THE NORTHWEST.

"I had an opportunity," says Mr. Rothe, "to observe and study the results caused by the destruction of the forests in the Northwest. Thirty years ago steamboats drawing six feet of water made regular trips on the Upper Mississippi up to St. Paul. Now the navigation with boats of half that draught is uncertain. Nearly all the tributaries of the Upper Mississippi have also lost one-half, or even more, of their former supply of water. Inundations in the spring are now frequent, while now in the summer time the depth of many of these rivers averages hardly more inches than could be measured by feet thirty years ago. Water-powers, which were formerly deemed to be inexhaustible, have entirely been abandoned, or their failing motive power has been replaced by steam. In the remembrance of the older settlers the climate of Wisconsin and Minnesota was remarkably steady, the winters were long and cold, the supply of snow ample and regular, and late frosts in the spring were unusual. Now the inhabitants complain of abrupt changes of the temperature in all seasons of the year, and of the irregularity of the snow-fall. The legislature of Wisconsin has already paid attention to these alarming facts, and has taken the preservation of existing forests and the establishment of artificial ones into earnest consideration. By a resolution recently passed, it asks of the national government the transfer for that purpose of all unsold public lands to the state which are now despoiled of their timber by thievish lumbermen."

NEVADA.

The Nevada *Enterprise*, in speaking of the effect that the partial stripping of forests on the sides and summits of the Sierras will have, says: "Already one change has occurred that is evident to the most ordinary observer, which is the speedy melting away of the snow on the mountains. It now goes off at once in a flood, with the first warm weather of spring, whereas, formerly, lying shaded and protected by the pines and other evergreen trees, it melted slowly, and all summer sent down to the valleys on both the eastern and western slopes of the Sierras constant and copious streams of water. Instead of a good stage of water in our streams throughout summer as in former times, there is a flood in the spring, and when this is past by, our rivers speedily run down, and, being no longer fed from the mountains, evaporation leaves their beds almost dry when the hot weather of summer comes on."

ARIZONA.

In the Territory of Arizona an immense number of deserted Indian dwellings carved out of the rocks were recently discovered. The former inhabitants of the same must necessarily have been a sedative people, devoted to agriculture, but the whole district is now nearly a desert, there being no supply of water, and hills as well as plateaus and valleys are dry, stony, and nearly destitute of vegetation. This

cannot have been the condition of that district when it was densely populated by hundreds and thousands of Indians. Now the only plausible solution of the ethnographical enigma which is here propounded to us is the following: The hills and slopes there were once stocked with lumber, which was wasted by the inhabitants. The same deterioration of the country gradually took place which we notice in Palestine, Greece and Sicily, where the people had to emigrate to avoid starvation.

But enough of the warning examples of history.

It is not too late to repair all the damage that has been done in Vermont and adjacent states by the devastation of our natural forests. A regulation of the use of the timber may be effected without any injury to the legitimate lumber trade, and the replanting as well as the establishment of artificial forests, may undoubtedly be made profitable for private as well as for public enterprise. If it is remunerative to acclimatize and extensively raise American trees in Germany and France, where the soil is much higher in price than here, why should it not be lucrative to cultivate them here. They grow quicker here and to greater perfection than anywhere else. Nature has lavishly provided for the United States an uncommonly large number of the most valuable species of trees. There are not more than thirty-five species and distinct varieties of native trees in France which attain to a height of over thirty feet, not more than sixty-five in Germany, but over one hundred and fifty in the upper part of the Mississippi Valley alone. All Europe possesses not a single native walnut tree. (The so-called English walnut is of Asiatic origin.) We have nine varieties of hickory and two of walnut proper. You may search all the world over in vain to find a sort of timber which, in general usefulness, can rival our hickory tree. Our walnut and oak varieties alone outnumber all the varieties of trees native to France and Spain.

A benign nature has lavishly provided for this country: but does that give us a right to waste these blessings, destined for the human race of all future ages, within the short life of a few generations, like spendthrifts? Shall we adopt the most detestable motto of a modern Sardanapalus, "*Apres nous le deluge?*"—anticipate every thing, and leave nothing for those who will come after us? Will America's pride bear the humiliating prospect of having the immense work of culture, which so far has been achieved in this country by the most intelligent, independent, progressive, and energetic of all nations, frustrated by the unavoidable consequences of our greedy mismanagement of the natural resources of our country? Shall the future of this great republic be made uncertain by a gradual deterioration of soil and climate, or shall it forever remain the happy and comfortable home of the free? Is not the care for future generations one of the most solemn duties imposed upon us by laws of humanity and morality. Are we worthy to enjoy the bequest of our forefathers if we are not just and liberal enough to provide for our descendants.

There are numerous examples where man has rendered the country sterile, and by planting forests regained its fertility; I give a few examples:

GERMANY.

Phipps says, the progress made by Germany in tree-planting is but a part of her general progress. The credit is given to the great Frederick; it was part of the national policy of his day which raised Prussia from a small power to a great one, and to the energetic continuance of that policy Germany owes Sadowa and Sedan. By this forethought, vast armies have been maintained, where once the sandy deserts would not nourish a flock of goats, and successive regiments of hardy soldiers have poured forth from the fertile soil where, two hundred years ago, the rugged *debris* of winter torrents, the thorn and the thistle, overspread a thirsty and impoverished land.

ST. HELENA.

The Island of St. Helena, the well-known scene of Napoleon's banishment, furnishes a remarkable illustration of the connection that exists between forests and rainfall. When first discovered, in 1502, it had heavy forests. The introduction of goats, and other causes, destroyed these woodlands, until the island was almost denuded. The consequences were that in the records of the last century we find accounts of repeated and almost periodical visitations of very severe drought, occasioning various losses to cattle and crop efforts. Towards the end of the last century, however, the governor saw the need of strenuous efforts. Gardeners were sent for, and trees from all parts of the world were planted, without regard to their character. The "Pinas Pinaster" was sown very extensively, and several plantations of this still exist. The consequences of this were discovered a few years ago, as follows: "For many years past, since the general growth of our trees, we have been preserved from the scourge, and droughts such as were formerly recorded are now altogether unknown. Our fall of rain is now equal to that of England, and is spread almost evenly over the year."

FRANCE.

In France the aristocrats had preserved the forests. But when Jacques Bonhomme had overthrown their tyranny, he proceeded to destroy the groves and forests, and in a short time he succeeded in almost staying crop growth in the fields adjacent. Wiser councils now prevail; experience has borne its fruits, and the French forests, particularly near the sea, bear witness how rapidly Providence assists a liberal, how sternly she repays a greedy and grasping, cultivator.

PROVINCE OF DUBEN, SAXONY.

S. B. Gould says that in the Prussian province of Saxony, the town of Duben celebrates an annual festival. The forests surrounding it had been recklessly cleared, and the sand banks which lay to the north-east began at once to move. Long tracts of corn land were converted into a sandy waste. The waves of gritty particles began to overleap the hedges and overflow the gardens under the walls of

the town. Vegetables became scarce, pasture for cattle rare, and the most serious results were feared, when the foresters of the district offered to arrest the desolating invasion. Fifty years have elapsed since then. Now, rich woods of acacias, birch, and pine wave over the sandy hills, and with their fine network of rootlets, hold the restless sand in its place and compel it to quiescence. Every year the citizens of Duben turn out with music and banners, into the woods, and celebrate with great jubilation the salvation of their town.

SWITZERLAND.

In no country in Europe has the waste of forests been more rapid or destructive than in Switzerland, and in none, perhaps, has this improvidence been followed by more disastrous results. The woods, being considered common property, were uprooted, and the soil on the mountains, being exposed to the wash of the rains, was rapidly carried away, leaving broad areas of naked rock, from which the water would at once sweep down the valleys in sudden and destructive inundations. The autumn of 1868 is memorable on account of these floods. Public attention has, however, been thoroughly awakened, and active preparations are in progress to remedy the evils. The cantons which have charge of these operations have for some time, at great expense, been constructing works to control the streams, and planting trees. The matter is now in Switzerland taken in hand by the national government, and in the past few years of their control the advantages are evident.

EFFECTS OF THE CUTTING OF FORESTS ON WATER SUPPLY OF RIVERS.

M. Cantegril says, that upon the territory of the commune of Labrugniere (a village of France) there is the forest of Montant, containing 4,524 acres, and owned by the commune. At the entrance of the forest, and along this brook, will be found several fulling mills, each requiring eight-horse power, and moved by water-wheels which work the belters of the machines. The commune of Labrugniere had long been noted for its opposition to the forest regulations, and the cutting of wood, together with the abuse of pasturage, had converted the forest into an immense waste, so that this great property would hardly pay cost of guarding it, and afford a meager supply of wood for its inhabitants. While the forest was thus ruined and the soil denuded, the waters after each heavy rain swept down through the valley, bringing with them great quantities of gravel, the *debris* of which still encumber the channel of the stream. The violence of these floods was sometimes so great that they were compelled to stop the machines for some time. But in the summer time another inconvenience made its appearance. Little by little the drought extended, the flow of waters became insignificant, the mills stood idle, or could run only occasionally for a short time.

About 1840 the municipal authorities began to inform their population relative to their true interests, and under the protection of better supervision the work of replanting has been well managed, and

the forest is to-day in successful growth. In proportion as the re-planting progressed, the precarious use of the mills ceased, and the regulation of the water-courses was totally modified. They now no longer swell into sudden and violent floods, compelling the machines to stop, but the rise did not begin until six or eight hours after the rains began. they rose steadily to their maximum, and then subsided in the same manner. In short, they were no longer obliged to stop work, and the waters were always enough to run two machines and sometimes three. This example is remarkable in this, that all the other circumstances had remained the same, and therefore, we could only attribute to the re-foresting the changes that occurred, namely, diminution of the flood at the time of rain and an increase in its flow during common times.

FLOODS.

Let us listen to what Phipps says of our country, and he must be without prejudice, and the same is as true of every state as of the whole country: "The reckless destruction of forests, so strongly condemned by many American writers, which has been practiced by their countrymen, is now bearing its fruits in the terrible spring and autumn floods which of late years have affected large portions of the United States. The Americans might spare much of their care for the channels of the Mississippi if they would restore the groves cut from the hills which feed its sources. To disforest a mountain slope is to devote the height to barrenness, the valley to flood, and both to parching drought when drought is most injurious."

DENMARK.

We learn from the "Encyclopœdia Britannica" that the water supply of Denmark is very meager, and the reason is that it is one of the most poorly wooded countries of Europe, the percentage of woodland being now only 4.25 of the whole area. This small proportion is caused chiefly by the nakedness of the western part of Jutland, where the west winds have seconded the action of man in destroying the forests. Much of the wood, which at one time covered nearly the whole of Denmark, having been cut down to make way for agriculture, and to supply fuel and timber, a vast area thus bared has become a sandy, healthy desert.

Effective measures are now taken by the Danish government to preserve the remains of the woodland, and to create new plantations. The state forest department permits only small portions of old forests to be cleared at a time and insists on simultaneous planting of an equal area. The Danish forest school is at Copenhagen, and forms a branch of an agricultural college.

Schacht, professor of the university at Bon, remarks that "wherever the forests have disappeared, the spring inundations of the rivers have acquired a frequency unknown before. It cannot be disputed that the terrible destructive effects of the inundations of the Loire and the Vistula, of late years, must be in great part attributed to the excessive denudation of the forests."

Marsh says that "the protection afforded by the forest against the escape of moisture from its soil by superficial flow and evaporation insures the permanence and regularity of natural springs, not only within the limits of the woods, but at some distance beyond its borders, and thus contributes to the supply of an element essential to both animal and vegetable life. As the forests are destroyed, the springs which flowed from the woods, and, consequently, the greater water courses fed by them, diminish both in number and volume. This fact is so familiar in the United States and the British provinces that there are few old residents of the interior of those districts who are not able to testify to its truth as a matter of personal observation. My own recollection suggests to me many instances of this sort; and I remember one case where a small mountain spring, which disappeared soon after the clearing of the ground where it rose, was recovered about twenty years ago by simply allowing the bushes and young trees to grow up on a rocky knoll, not more than half an acre in extent, immediately above the spring. The ground was hardly shaded before the water reappeared, and it has ever since continued to flow without interruption. The hills of the Atlantic States formerly abounded in springs and brooks; but in many parts of these states, which were cleared a generation or two ago, the hill-pastures now suffer severely from drought, and in a dry season furnish to cattle neither grass nor water."

Are we not all witnesses to this truth? Yes, under our very eyes every year we see the never failing springs of old dry up, and our streams sink into insignificance, that fifty years ago was even never dreamed of.

IMMENSE AMOUNT OF WATER GIVEN TO THE ATMOSPHERE BY TREES.

A few years ago a number of scientists of New England made a calculation as to the amount of water given to the atmosphere by the "Washington Elm," Cambridge, Mass. They calculated that the leaves of that tree would cover over 200,000 square feet of surface, and that they gave out every fair day during the growing season 15,500 pounds, or $7\frac{3}{4}$ tons, of moisture.

The rising atmosphere cooled and charged with water by such evaporation, is what brings down to us the evaporation of tropical seas that would otherwise pass beyond our borders.

It has been said that the torrid seas send, at least, sixteen feet in depth of all their surface into the atmosphere each year. It has also been calculated that about six feet of that water returns to those seas in rain, but that the other ten feet is sent towards the poles, and hence half or more of it starts on its northward journey. If Vermont could get ten inches annually more than she does, she would rival in fertility any other section of the known world, and I verily believe that if all her waste places were restored to timber, which would give us a timber area of about forty per cent., that much of this might be gained. Is it not well worth our trial?

HEALTHFULNESS OF FORESTS.

Emerson says, that the influence of forests on the healthfulness of the atmosphere demands thoughtful attention. Plants imbibe from the air carbonic acid, and other gaseous and volatile products, exhaled by animals or developed by the natural phenomena of decomposition. These the trees, more than the smaller plants, absorb, and instead of them pour into the atmosphere pure oxygen, essential to the life of animals. The carbon, the very substance of wood, is taken from the carbonic acid thus absorbed. "Humid air, says Bequerel, 'charged with miasmata, is deprived of them in passing through the forest.'"

Schacht says, "That the forest is the natural protection against wind." In this respect the forest cannot be without beneficial effect on the adjacent country; the young growth of trees flourishes, screened from the force of the wind, the arable land develops itself better, sands meet an impassable barrier, and the noxious influence of the dry winds is turned aside. It is, then, indisputable that the forests exercise a salutary influence on the temperature of a country. The sanitary condition of man and the domestic animals, as well as the growth of cultivated plants, depends on the climate of the locality. The fertility of a country depends on its supply of forest land; for on this depend the foundation of soil, the precipitation of dew, the fall of rain, the steady current of rivers, the mitigation of the evil influences of unhealthy winds, and the growth of vegetables in the fields and meadows.

Daniel Millikin believes the malaria of the south and west is from the want of forests, and the fever and ague recently visiting southern New England where the forests are small and scarce, seems to substantiate it as fact. He says: To arrest a pestilence by quarantine, the state sternly interrupts trade, travel, and pleasure; but the far greater mortality from the increasing fickleness and cruelty of our climate can be arrested by the gentlest means. It is needed only that our broad states shall have one-fourth of their surface covered with trees—which, by the way, may be so distributed as to increase the value and producing power of lands. It is needed only that the road sides shall be well planted, that all hills shall be fixed forever with woods, that the rivers shall be fringed with appropriate species, and that woods shall be wood, in fact, and not struggling collections of the dying monarchs of the primeval forest. Along with a better climate will come not only the better health and longer lives, but forgotten springs will gush anew from the hills, the attenuated streams will fill their banks again—and yield us a better fish supply—and will cease to drown the valleys with floods after every rain.

The legislature of Vermont has made a move in the right direction, now let them go forward instead of backward. Men need be taught to plant trees, and their children to plant and love them. Owners of good lands in Vermont or elsewhere, will by and by learn that if their unproductive fields are planted with wood to full forty per cent. of their area, that the sixty per cent. will produce much more than all does under their present tillage. Legislators rely on the people. Let

the people in accord with their best interests memorialize the legislature that they provide for exemption from taxation, for twenty to fifty years, all cleared land, on which forest trees are successfully cultivated for three years, and maintained in a thriving condition thereafter.

Once planted and fairly started, they will take care of themselves, give no trouble, and increase yearly in value. If every acre of ground were covered with valuable crops, one would try and get reconciled to the absence of trees, and bow to the iron rule of our age which converts everything into cash. But what a small proportion of all that ground is used profitably! We can find plenty of spare room for growing forest trees; they are not only the most beautiful ornaments to a country, and the most useful product of nature, giving fuel, timber, shade, shelter, retaining moisture, and a protection against droughts, etc., etc., but, considering the question from a *strictly money-making* point of view, the culture of forest trees is perhaps the *best and safest investment* that can be made.

But this is not the only consideration. The objects of the restoration of the forests are as multifarious as the motives which have led to their destruction, and as the evils which that destruction has occasioned. The planting of the mountains will diminish the frequency and the violence of river inundations, prevent the formation of torrents; mitigate the extremes of atmospheric temperature, humidity, and precipitation; restore dried up springs, rivulets and sources of irrigation; shelter the fields from chilling and from parching winds; prevent the spread of miasmatic effluvia; and, finally, furnish an inexhaustible and self-renewing supply of material indispensable to so many purposes of domestic comfort, to the successful exercise of every act of peace, every destructive energy of war.

> "Where trees are not, behold the deserts swoon
> Beneath the brazen sun and mocking moon.
> Where trees are not, the tawny torrent leaps,
> A brawling savage from the crumbling steeps."

In Germany, France, Italy, and in fact many other countries of Europe, trees are planted by the government upon the sides of the highway. Let us do likewise. In France they report 2,878,603 trees on the roadsides. In Germany many thousands of miles of roads are shaded by trees; in some parts they are forest trees, in others fruit trees. I regret that I haven't the exact statistics. The planting of the same has, to a considerable extent, prevented hail storms, which, in some sections, prevented the growth of the vine. It is now seldom injured. This is another conclusive link in the chain of testimony that as there is nothing of greater importance to the agriculturist than rain at the proper season and in proper quantity; and science has demonstrated that the forests of a country are potent in the regulation of storms, the formation of clouds, and the descent of rain; that such aids as vitally affects the interests of the farmer and producer affects the whole state, and demands the earliest attention of the people's representatives.

Again, there is, as Irving says, "something nobly simple and pure in a taste for the cultivation of forest trees." It argues, I think, a sweet and generous nature to have this strong relish for the beauties of vegetation, and this friendship for the hardy and glorious sons of the forest. There is a grandeur of thought connected with this part of rural economy. It is, if I may be allowed the figure, the heroic line of husbandry. It is worthy of liberal, and free born, and aspiring men. He who plants a tree, looks forward to future ages, and plants for posterity. Nothing can be less selfish than this.

> "O whispering trees, companions, sages, friends,
> No change in you, whatever friendship ends;
> No deed of yours the Eden link e'er broke;
> Bared is your head to ward the lightning's stroke.
> You fed the infant man, and blessed his cot,
> Hewed from your grain; without you he were not,
> The hand that planned you planned the future, too.
> Shall we distrust it, knowing such as you?"

INSECTS.

By Dr. Hiram A. Cutting, Secretary.

OUR INSECT FRIENDS.

SPIDERS.

Arancida.

Spiders are always found where not wanted, and generally dreaded by children, yet are really our friends. All know they catch flies and all winged denizens of the air, but all do not think of the great advantage they are in our grass and grain fields; yet such is the fact. Two typical species are represented in Plate I, Figures 5 and 6.

APHIS LIONS; GOLDEN EYE.

Chrysopa vulgaris.

In Plate I, Figures 7 and 8, may be seen one of our beautiful little friends that wage constant war with the Aphidis, or plant lice. The eggs are laid by the lace wing fly, called Golden-eye, and the larvæ are called Aphis lions; they are so bloodthirsty for the aphis. Their color is usually green, and I have found them most abundant on rose bushes, as we all know that bush is almost always infested with the aphis. The fly, upon being disturbed, emits a disagreeable, fetid odor. Their eggs are white and are supported by long foot-stalks, as shown in the figure, usually upon plants infested with plant-lice. The larvæ are active and extremely voracious. There are two or more broods in the course of the summer, and the last brood winters in the chrysalis state, protected by a compact, round, whitish cocoon.

MOSQUITO-HAWKS, DRAGON-FLIES, OR DEVIL'S DARNING-NEEDLES.

Neur., Fam. *Libellulidœ.*

These insects, in the adult stage, are so well known as not to warrant description. The eggs are laid in the water, either indiscriminately dropped or deposited around the stem of some aquatic plant. The larvæ are predaceous, living upon other aquatic insects. The habits of the perfect insects are also predaceous. (We figure (Plate II, Figure 1) one of the most common species, *Libelula trimaculata.*) They catch and eat numbers of insects upon the wing. They especially prey upon mosquitos and black flies. Many children fear them, but they are perfectly harmless, though their large eyes make them have a ferocious look.

CAMEL CRICKET.

Orth., Mantis Carolina.

The eggs are shown. (Plate II, Figure 2.) The predaceous character may be known by the fact that a single Mantis has been known to kill and eat eleven Colorado potato beetles in a single night. Not yet seen in Vermont.

Fig. 6.

Fig. 5.

Fig. 8.

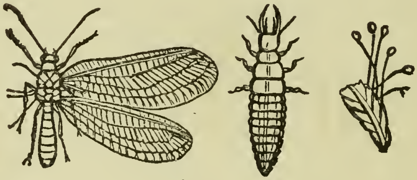


Fig. 7.

Plate I.

THE SPINED SOLDIER BUG.

Arma spinosa.

This order, Hemiptera, contains many cannibalistic insects, but the spined soldier bug is one of the most common and friendly. (Plate II, Figure 3.) Let every farmer protect him.

THE GREEN SOLDIER BUG.

Raphigaster hilaris.

This is also a deadly enemy of the potato beetle, and is shown in Plate II, Figure 4. All this class of beneficial insects should be protected by all. But we should first know them.

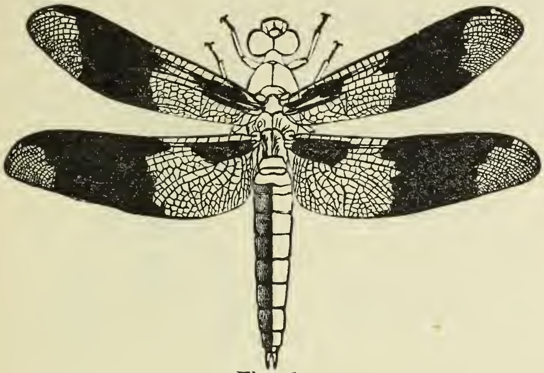


Fig. 1.


Fig. 4.


Fig. 3.


Fig. 2.

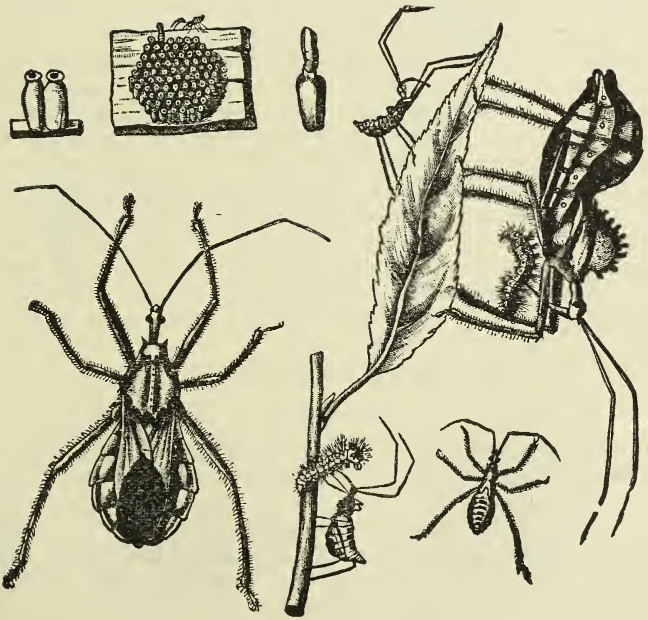


Fig. 5.

Plate II.

WHEEL BUG.

Prionotus cristatus, Lin.

This is a deadly enemy to caterpillars, plant lice, etc. They kill their prey by inserting their beak and injecting a powerful poison. Their bite is more to be dreaded than the sting of a wasp. (Plate II, Figure 5).

METAPODIUS.

Acanthocephala femorata.

The report of the United States Department of Agriculture says, it is so called from its swollen, spiny thighs, is a large reddish-brown or blackish insect, quite abundant in the Southern cotton fields. It is very slow in its motions, and appears to be fond of basking in the sun. The thighs are strongly developed and spiny, especially on the under side, while the shanks have broad thin plate or leaf-like projections on their sides, which gives these insects a very peculiar appearance. The eggs are smooth, short, oval, and have been found arranged in beads like a necklace on the leaf of white pine. The full-grown insect is said to injure cherries in the Western States by puncturing them with its beak and sucking out the juices, thus proving it, at least in one instance, to be a feeder on vegetable substances. Not plenty in New England. (Plate III, Figure 1).

RAPACIOUS SOLDIER BUG.

Sinea multispinosa, De Geer.

This insect is found in every part of the country, and is abundant in Vermont. When young they live upon plant lice, but upon attaining their growth, they attack our most troublesome insects, as the caterpillar, canker worm, potato beetle, etc. Their eggs are about the size of a pin's heed, and are usually laid in two parallel rows upon the bark or limbs of trees; sometimes upon a small twig, and each egg is bordered by a row of short prickles. When newly hatched, the young soldier bugs may be frequently found in the curl of the common elm-leaf plant-louse (*Schizoneura Americana*), and also the common apple aphis (*Aphis mali*), busily engaged in devouring the lice. We should specially look out that we do not destroy their eggs, as those of an enemy. The full-grown insect is shown in plate III, Figure 2. Plate III, Figure 3, represents (*Erax-apicalis*, Wied,) a fly that feeds upon grasshoppers and other pests, but I have never seen it in Vermont.

TIGER BEETLES.

Cincindelidœ.

The order Coleoptera contains very many friends, and the tiger beetles are especially so. Plate III, Figures 4, 5 and 6, shows a variety of the more common of this group. They should everywhere receive protection. A larva is also shown in Figure 6.

It is certainly necessary that a man may know his friends as well as his enemies, that he may not use all alike in a universal hatred that always destroys, as opportunity offers.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

a b c

Fig. 6.

Fig. 5.

a b

Fig. 7.

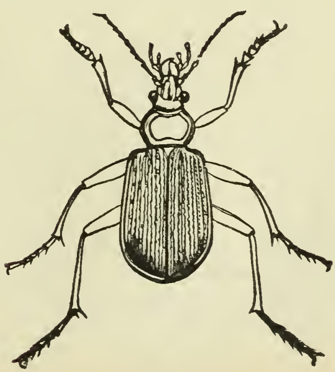


Fig. 8.

GROUND BEETLES.

Carabidæ.

Almost all the beetles of this family are carniverous, and do the farmer much good by destroying injurious insects. These insects are to be found during the day under sticks and stones and under the bark of trees, from which places they go out at night to hunt for their prey. The larvæ live in similar situations and are also nearly always predaceous. The generalization is made by Packard that they are "generally oblong, broad, with the terminal ring armed with two horny hooks or longer filaments, and with a single false leg beneath." (*Calosomas crutator*, Fabr.,) shown at plate III, Figure 8. According to Harris, this insect is known to ascend trees in search of canker-worms and similar insects. Another beetle of similar habits is (*Calosoma callidum*,) shown at Plate III, Figure 7. Mr. Glover, in the 1855 report, figures a species of *Harpalus*, probably *H. caliginosus*, Say. (see Plate IV, Figures 1, 2), and in the text refers to it as being abundant. Figure 2 represents the larval form.

SOLDIER BEETLES.

Coleopt., fam. *Lampyridæ*, genus *Chauliognathus*, Hentz.

The family *Lampyridæ* is popularly known as the fire-fly family, and the adult beetles are too well known to need description. In the perfect state they are nearly all vegetable feeders, while the larvæ are nearly all carniverous. Plate IV, Figures 3 and 4 represent two species. The larva are long, slender, flattened, tapering toward the ends, active, with large jaws, usually blackish, with pale spots at the angles of the segments.

LADY BIRDS OR LADY BUGS.

Family *Coccinellidæ.*

Riley says of them "The 'lady-birds' are better known, perhaps, than any other family of beetles. They are small, round, and hemispherical, usually red, yellow, or black, with spots of one or the other of these colors. All are carnivorous except *Epilachna*. The eggs are usually long, yellow, and oval, and are laid in patches, often in the midst of a group of plant-lice, which the newly-hatched larvæ greedily devour. The larvæ, Plate IV, Figure 6, are long, soft-bodied, rather pointed toward the end, and are quite active. The jaws are small and inconspicuous. They are often quite gaily colored, and covered with scattered tubercles, spines, or tufts of hair. They attain their full growth in three to four weeks. When about to transform to pupæ they attach themselves by the end of the body to a leaf or twig, and either throw off the old larva skin, which remains around the tail, or retain it around the pupa for protection. The pupa is small and rounded, simulating the true beetle. The perfect insect comes forth in about a week. The larvæ feed upon plant-lice and other small insects, of which they destroy immense numbers. The adult beetles also destroy other insects, although in lesser numbers than the larvæ.

Fig. 1.

Fig. 3.

Fig. 4.

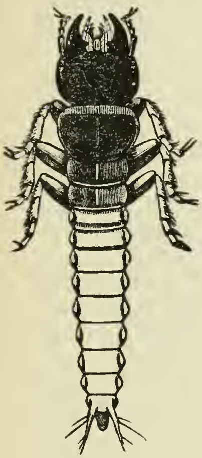


Fig. 2.

Fig. 5.

Fig. 7.

Fig. 8.

Fig. 6.

Fig. 9.

Fig. 12.

Fig. 10.

Fig. 11.

Fig. 13.

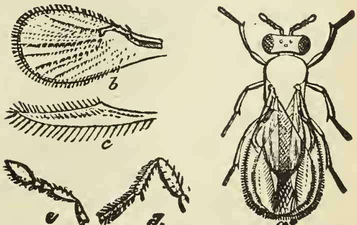


Fig. 14.

Plate IV.

Coccinella novemnotata, Herbst. (Plate IV, Figure 8, and pupa), is light yellowish-red in color, and may at once be distinguished by the nine black spots upon its wing-covers, arranged as shown in the figure, four upon each wing-cover, the two hind ones being the larger, and one in front on the middle line. *Coccinella munda* (Plate IV, Figure 7,) is a smaller species of precisely the same color, but without any spots upon the wing-cover. Its thorax is black, with two small light spots. *Hippodamia convergens* (Plate IV, Figure 6,) resembles the preceding in general ground color. It is larger and more elongated. On the wing-covers are thirteen small black spots. The thorax is black, with a light yellow margin, and two lines of the same color approaching a V in shape. *Hippodamia maculata* (Plate IV, Figure 5,) is pink in color, with ten large black spots on the wing-covers, of which two are upon the middle line. The thorax is pink, with two large black spots, and the head is pink, with black eyes. It is smaller than the last named species. *Coccinella venusta* (Plate IV, Figure 9,) is larger and broader. It is pink in color, with ten large black spots upon the wing-covers, of which the hind two blend into each other across the middle line. The inner middle spots are shaped like inverted commas. The thorax is pink, with four black spots, of which the two hinder ones meet across the middle line to form a V. *Chilocorus bivulnerus*, Muls. (the twice-stabbed lady-bird), is hemispherical in form, and shiny black in color. A little in front of the middle of each wing-cover is an irregular bright red spot. The thorax is black, with a whitish border, and the head is whitish, with black eyes.

We figure (Plate IV, Figure 10,) the *only* vegetable-feeding lady-bird, in order that those interested may know what it is, and not consider it a beneficial species. It is known as *Epilachna borealis*, Thunberg. It is much larger than any before mentioned, is of a light reddish yellow color, with seven large black spots upon each wing-cover. The thorax is of the same color and has four small black spots. The head is concolorous with the thorax, and the eyes are black. Both the larvæ and perfect insects feed upon the leaves of cucumbers, melons, squashes, and pumpkins—eat unsightly holes in them, and, when numerous, completely destroy the plant. Another beetle, of injurious proclivities, is often mistaken for a lady-bird by the farmer, although it belongs to an entirely different family. This is the twelve-spotted Diabrotica, *Diabrotica duodecim-punctata*, Fabr. This insect is shown at Plate IV, Figure 11, and certainly does resemble Coccinella to the untrained eye. The principal points of difference between it and the common Hippodamias, which it most resembles, are that the Diabrotica is usually greenish, varying occasionally to yellowish, that it has twelve black spots arranged in parallel rows down the wing covers, and that the thorax is green and unspotted The twelve-spotted Diabrotica belongs to the family *Chrysomelidæ*, or leaf-eating beetles. Dr. Packard states that they devour the leaves of dahlias, and they are commonly found gnawing melons, squashes, and cucumbers.

I also here give another Plate, IV*a*, that contains a greater variety, so great in fact that with the appended description of Comstock it will enable one to recognize as belonging to this important and friendly

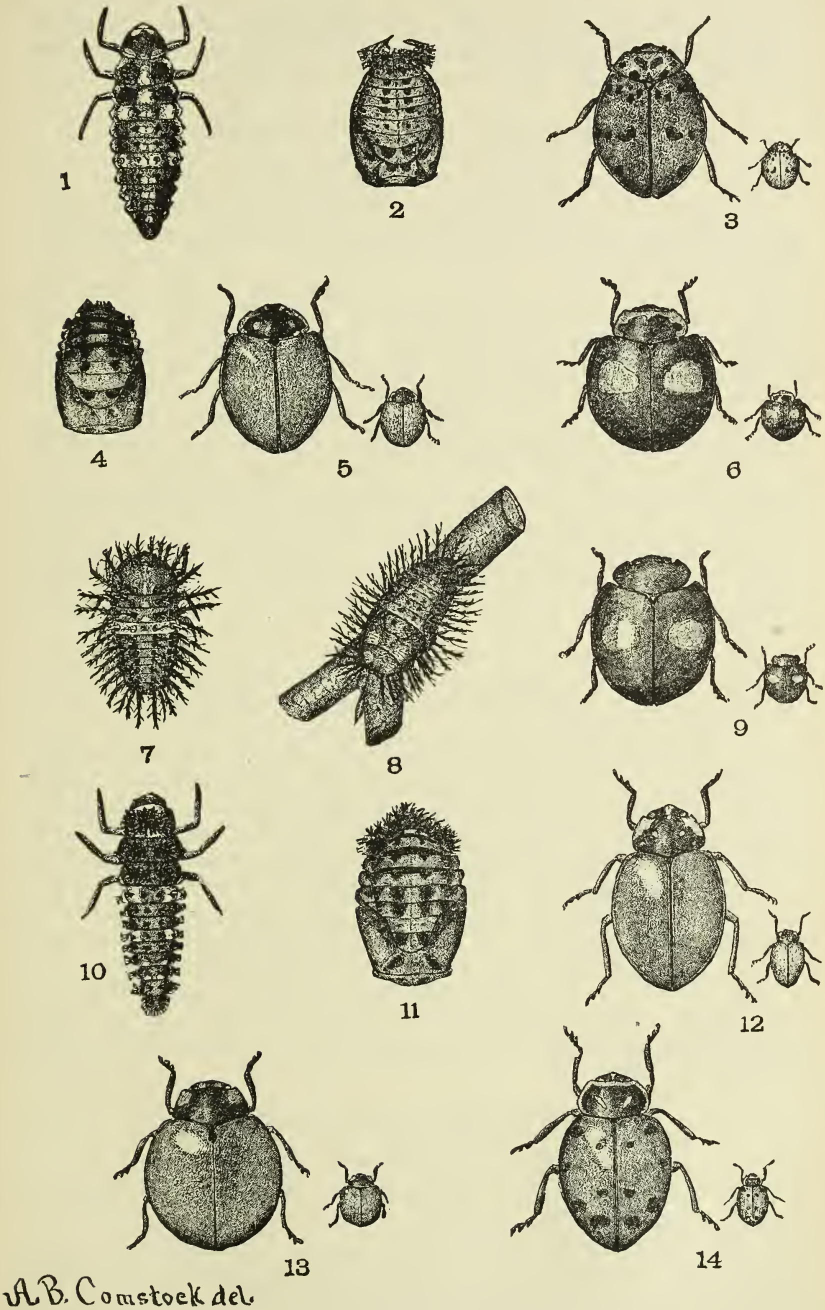


Plate IV*a*.

family any members he may find. In case of the adult of each species described here two figures are given, the smaller one indicates the size of the insect, the larger one the markings.

THE ASHY-GRAY LADYBIRD.

Cycloneda abdominalis, Say.

This little beetle was found very abundantly upon different trees infested with an aphid, and as it has not been before described, we submit the following:

Description of larva.—Plate IV*a*, Figure 1. Length when full grown, 10^{mm}; color spotted with dirty greenish-white; black and orange above; face yellow, remainder of head black; prothorax black, irregularly margined before and behind with light yellow; mesothoracic segment with a broad longitudinal dorsal yellow stripe; metathoracic segment with a broad central dorsal spot; each of the abdominal segments, except the last, with a dorsal yellow spot, which upon the fourth abdominal segment is very broad; segments 1 and 4 each with a pair of subdorsal yellow spots; all segments except the last with a row of lateral yellow spots on each side. There is a pair of small subdorsal black spots to each abdominal segment, and much larger ones to the meta and mesothoracic segments. Upon abdominal segments 2, 3, 5, 6, 7 and 8 is also a pair of small dorsal-sublateral black spots.

When about to transform to a pupa this larva attaches itself to a leaf by the end of its abdomen, and the skin, splitting at the back of the head, shrinks back about the posterior end of the body.

Description of pupa.—Plate IV*a*, Figure 2, Length, 5^{mm}; shape, broad oval, the width being about 3.5^{mm}; general color white, tinged in some lights with purplish; around margin slightly yellowish; wing-covers yellowish; all spots black, those on the thorax and wing-covers resembling in form, size and position those on the adult insect. On the dorsum of each abdominal segment except the first, is a transverse row of four black spots. These are largest on the third segment and decrease in size toward posterior end of body, those upon the second segment being very small. There are also small black lateral spots on the third and fourth, and a trace of one on the fifth segment.

The adult beetle is a small ashy-gray insect of the usual semi-globular shape. There are seven black spots on the thorax, and eight upon each wing-cover, of the size and shape indicated in the figure (Plate IV*a*, Figure 3).

THE BLOOD-RED LADYBIRD.

Cycloneda sanguinea, Linn.

This species is not so common as the one just described, and we are only able to describe the pupa.

Description of pupa.—Plate IV*a*, Figure 4. Length, 5^{mm}; width, 3.5^{mm}; shape, broadly oval. General color of body dirty yellow; median line of thorax of a light orange color; first, fourth and fifth abdominal segments terminate laterally with bright orange-colored

spots, and the fourth abdominal segment bears two dorsal spots (one each side of the median line) of the same color; there is also a subdorsal row of black spots on each segment except the second abdominal; wing-covers blackish.

The adult beetle is small (5^{mm} long), and is almost hemispherical in shape. Its color varies from brick-red to blood-red; thorax black, with two orange spots, and edged with the same color, and head black, with two light spots. (Plate IV*a*, Figure 5.)

This is a common species all over the country, and is frequently mentioned in entomological reports, under Say's name of *Coccinella munda*, as preying upon injurious insects.

THE LADYBIRD OF THE CACTUS.

Chilocorus cacti, Linn.

A number of the larvæ of this insect were found preying upon the black scale upon oleander, and the beetles themselves were found abundantly upon different plants.

Description of larva.—Plate IV*a*, Figure 7. Length, 6^{mm}. The body is covered with many long spines, each of which is armed with delicate supplementary spines. The color is entirely black, with the exception of the first abdominal segment, which is light yellowish, the spines of the same color as the segment except at the tips, where they, too, are black.

Description of pupa.—Plate IV*a*, Figure 8. The pupæ formed within the larval skin, which simply splits along the back sufficiently to show the inclosed pupa, but still remains around it and protects it. The pupa is perfectly smooth with the exception of sparsely-scattered tufts of fine hair, shining and black in color.

The beetles themselves are shining black in color, with an irregular reddish spot on each wing cover, and closely resemble the "Twice stabbed Lady-bird" of the East (*Chilocorus bivulnerus*, Muls.), well known to writers on economic entomology as destroying many injurious insects, particularly bark lice. (Plate IV*a*, Figure 9.)

THE AMBIGUOUS HIPPODAMIA.

Hippodamia ambigua, Lec.

This is one of the most abundant lady-birds found. The beetles and larvæ abounds on all sorts of trees, and are undoubtedly of much economic importance.

Description of larva.—Plate IV*a*, Figure 10. Length, when full grown, 10^{mm}. Color bluish black above, dirty green below; first thoracic segment margined with yellowish white; abdominal spots bright orange and black. The orange spots are arranged as follows: Two small spots on the posterior part of the metathoracic segment and a larger one on each side jnst above the leg; first abdominal segment with large subdorsal and lateral spots; second abdominal segment with small lateral spots, which are really the endings of two long lateral spots, beginning on the metathorax and extending across the

first abdominal segment, fourth abdominal segment, with subdorsal and lateral spots a little smaller than those on the first; sixth and seventh, each with small subdorsal spots.

Description of pupa.—Plate IV*a*, Figure 11. Length, 6^{mm}; width, 3.5^{mm}; general color dull orange yellow; prothorax yellow, with a dark, sometimes black, margin, a black spot on either side of the median line on both front and hind margins, also another on each side just external to those on the hind margin. In some specimens there are two dusky discal spots on the prothorax, which sometimes extend forward and unite with the middle anterior marginal spots. The wing-cases are tipped with black; the legs are black, and the abdomen furnished above with a double row (almost, if not quite, continuous) of black spots.

The adult beetle resembles the Blood Red Lady-bird, but is narrower in proportion to its length, and is flatter. The thorax is black, with its two fore-corners dirty white. The head is black, with the middle of the forehead whitish. It is about 6^{mm} long. (Plate IV*a*, Figure 12.)

Three other species were observed, but I was unable to procure specimens illustrating the early stages of these species. The adults are represented on the plate, and are as follows: Figure 6 represents *Cycloneda oculata;* this beetle has black wing-covers, with a large reddish spot on each. Figure 13 represents *Coccinella 5-notata*, variety *Californica*. In this variety the prothorax is black and the wing-covers pale orange. And Figure 14 represents *Hippodamia convergens*, a species which is common throughout the United States.

WASPS.

Vespariæ.

These well known insects as a class are insect eaters. It is now and then they eat honey bees, and are not thus beneficial, and they do some harm to fruit, yet as they prey largely upon injurious classes of insects and store up their larva also as food for their young, they are justly considered as friends. Figure 12, Plate IV, represents *Polistes bellicosa*, a common species. Plate IV, Figure 13, represent *Trichogramma minuta* and Figure 14 *Chalcis ovata*, both magnified. Though small they destroy insects by placing their eggs upon them; the larva eating them to mature themselves.

But we will now dismiss our friends that we may consider a few of our enemies.

OUR INSECT ENEMIES.

In consideration of these we shall draw largely from the United States Agricultural Report, as we consider that the best authority in our country. The first pest as studied up by Prof. J. H. Comstock and published in said report, is

THE APPLE MAGGOT.

(*Trypeta pomonella*, Walsh.)

Order *Diptera;* family *Trypetidæ.*

(Plate V.)

Eating into the pulp of apples and causing them to decay; a white cylindrical maggot, which when full grown goes into the ground to transform. The adult is a black and white fly, with banded wings.

Without doubt the most important insect enemy of the apple is the Codlin-moth or Apple-worm, as it is often called. This is the small white or pinkish caterpillar which infests apples near the core, and in leaving the apple makes an ugly burrow through its side. The importance of this pest is due to two facts: first, it is very widely distributed, occurring almost everywhere that apples are cultivated; second, it is usually so abundant wherever it occurs that it destroys a large proportion of the fruit.

There is another enemy of the apple which, in certain localities, rivals the Codlin-moth in the extent of the injury it does. I refer to the insect known as the Apple Maggot, and which is becoming quite common in certain parts of New York and New England. This insect was described nearly fifteen years ago by Mr. Walsh, under the name of *Trypeta pomonella.* But the report in which this description occurs is now out of print, and almost unknown in the localities in which the Apple Maggot has attracted attention, except to entomologists. I will, therefore, give the result of the studies which I have made of this insect during the past two years.

The Apple Maggot is a small white footless larva, measuring from 5^{mm} to 7^{mm} (.19 to .27 inch) in length. In some instances the body is yellowish-white; in others it has a greenish tinge. The important peculiarity in the habits of this insect is that it bores tunnels in all directions through the pulp of the fruit; frequently these tunnels enlarge into cavities the size of a pea; and when several larvæ are present in the same apple it is honeycombed so as to be rendered useless.

It will be seen at once that the injury done by this pest is even more serious than that done by the Codlin-moth. For as the injury caused by the latter insect is confined to the neighborhood of the core and to a single, nearly straight, and conspicuous tunnel which the larva makes when leaving the apple, it often happens that the injured parts of an apple may be cut away and the remainder eaten. But the nature of the injury caused by the Apple Maggot is such that when fruit becomes infested by this insect no one cares to attempt to use it.

The Apple Maggot is a native American insect, which naturally feeds on the different species of hawthorn (*Cratægus*) and upon crab-apples. It is probable that this insect occurs throughout the country wherever hawthorns or crab-apples are found. Mr. Walsh observed it long ago as far west as Illinois.

In certain parts of New York and New England the species has acquired the habit of feeding upon the cultivated apple. But, what is very remarkable, it does not appear to have done so in other parts of the country, until last year when it became more abundant and general, and bids fair to rival the Codlin-moth in damage done. In

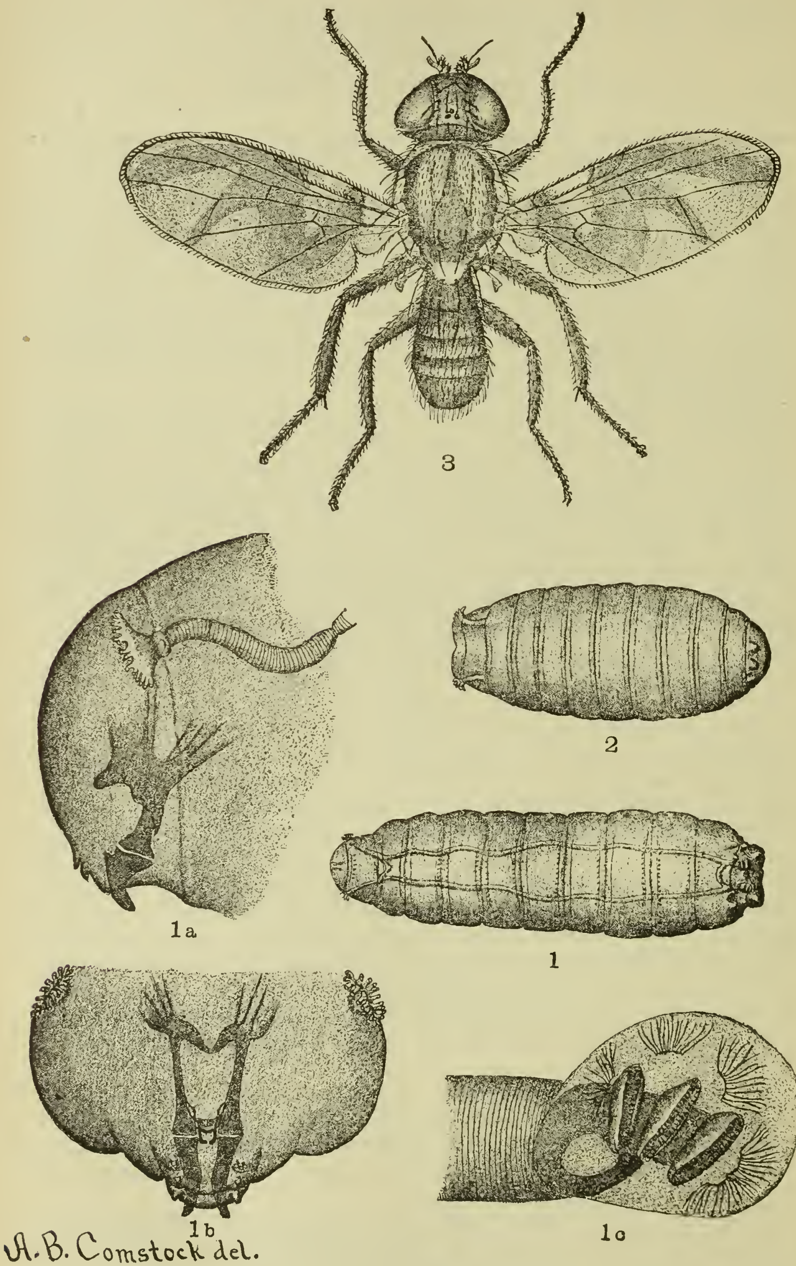


Plate V.

New Hampshire and Vermont it has been called the "Railroad worm," and the extent of its ravages were very great last season. Several men from Townshend and Wardsboro told me that their apples were ruined, and one had cut down his early trees believing that they would never be of value to him. Many of the early varieties all over our state were infested more or less.

Mr. Isaac Hicks of Long Island, one of the first observers of this pest, thinks they must be confined to early and mellow apples, as they cannot mature as he thinks in winter or hard apples. The last season, however, showed that now and then the winter varieties were infected, but it is evident, from my observations and from those of my correspondents, that the Apple Maggot is much more apt to infest early apples than the winter varieties.

Mr. Henry Thacker, of the Oneida Community, New York, writes as follows:

> This worm at this place, and at this time, is mostly confined to certain varieties of autumn apples. But at Wallingford, Conn., the winter apples were ravaged as well. Of late years, however, the Baldwin and some other varieties of winter apples growing here have been found bored by this maggot.

I will now give an account of each of the stages of this insect, which are represented on Plate v, excepting the egg, which has not yet been observed.

Larva.—According to my observations and all published accounts, the Apple Maggot does not occur in the apple till the latter part of the summer. As already stated, it is a footless larva about one-fourth inch in length and white in color, with sometimes a yellowish or greenish tinge. Several figures illustrating its form and structure are given on Plate v. Figure 1 represents its general appearance when greatly magnified. The caudal two-thirds of the body is cylindrical; the cephalic one-third tapers slightly to the head, which is the smallest segment of the body. On the dorsal surface of the body there is on each side, at the union of the first and second segments, a pale-brown tubercle. These are the cephalic spiracles. The structure of these spiracles is quite complicated. (See Plate v, Figures 1*a* and 1*b*). Each one is expanded into a plate, the free margin of which is fringed by a double series of cylindrical projections, about twenty in number. With a very high power of the microscope the distal end of each of these projections appears to be sieve-like; an arrangement which doubtless prevents the entrance of any foreign matter into the respiratory system. With a low magnifying power the main tracheæ connected with these spiracles may be seen. These are represented in Figure 1, a single large trunk on each side extending the whole length of the body. These are connected near each end of the body by a large transverse trunk. Many of the smaller tracheæ which branch from the main tracheæ are usually visible, but they are not represented in the figure. The caudal end of each of the two main tracheæ opens by means of a very complicated spiracle. These differ much in structure from the cephalic spiracles, and are situated on the last segment of the body. One of them, the right, is represented at Figure 1*c*. There are three transverse slit-like openings, which are fringed by a series of teeth, which are apparently chitinous. The function of these

teeth is doubtless the same as that of the sieve-like membrane closing the ends of the tubular projections of the cephalic spiracles. Each of the caudal spiracles is accompanied by four groups of bristles, two upon the lateral side and one each upon the cephalic and caudal sides.

The caudal end of the body is obliquely truncate, the ventral part projecting farther than the dorsal part. This sloping part of the body bears four pairs of tubercles. One pair of these is more prominent than the others.

The mouth is armed with two black, strong, curved, parallel hooks, which are used in rasping the food. The hooks are connected with an internal, apparently chitinous, framework, which is also black. This is figured from the side in Figure 1*a* and from above in Figure 1*b*.

These black oral hooks and the two pairs of spiracles, both of which are brown, are visible to the unaided eye, but their structure can only be made out by the aid of the microscope.

Pupa.—In the autumn, when the larva are full grown, they leave the apple and enter the ground and transform to pupæ. In my breeding cages the pupæ were found about one-half inch below the surface of the ground. When the change to pupa occurs the body shortens, but the larval skin is not molted, the transformation occurring within the dried skin of the larva. The pupa (Plate v, Figure 2), therefore, resembles the larva very much, except that it is shorter, of an oval outline, and of a pale yellowish-brown color. Length about 5^{mm} ($\frac{1}{5}$ inch).

Adult.—The insect remains in the pupa state during the entire winter and early summer. The adult fly is represented greatly enlarged at Figure 3. The actual length of the body of the male is 5^{mm} ($\frac{1}{5}$ inch); of the female, 6^{mm} ($\frac{1}{4}$ inch). This fly can be easily recognized by the peculiar shape of the black bands on the wings, by the milk-white spot on the caudal part of the thorax (scutellum), and by the white bands on the abdomen. A more detailed description follows:

The *head* is rust-red, with the eyes and the bristles black. The *thorax* is black, with a white stripe on each side, and two silvery stripes on the dorsal aspect; scutellum white except at base. The *abdomen* is black, with transverse silvery stripes above; of these there are in the male three conspicuous ones, making the caudal margins of the second, third and fourth segments; in the female there are four, which are less conspicuous, and are borne by the first to the fourth segments inclusive. The shape of the abdomen differs also in the two sexes. In the male it is as represented in the figure; the segments successively wider to the fourth. The margins of the first to the fourth segments form two divergent and nearly straight lines. In the female the abdomen suddenly enlarges, so that the second segment is the widest, and the outline of the whole abdomen is elliptical. The *legs* are pale rust-red; the four posterior femora, except at the proximal ends, are brownish black. The *wings* are hyaline, with four black cross-bands; the first, which it near the proximal end of the wing, is confluent with the second near the caudal border of the wing; the second, third and fourth are confluent near the cephalic margin of the wing and diverge caudal.

Remedies.—The more practicable ways of lessening the injuries caused by this pest are the destruction of infested fruit promply after its fall from the tree, and before the maggots leave it to go into the ground to transform ; and when the pest is very abundant, the grafting of the trees into varieties less liable to be infested. In such a case it might be well to leave one or two trees of early apples to serve as traps, and promptly destroy the fruit as it falls from them. If such trees could be inclosed, and sheep or pigs pastured under them, the success of the trap would be assured.

Kerosene oil in milk, thrown over the trees in weak solution with a garden pump, has, in cases where tried, seemed to prevent the depredations upon the fruit of that tree, and not injure the tree. Whale oil soap suds might also be efficacious. The sprinkling probably need not be done the first time until the 10th of August. As it is a serious pest, all ought to experiment upon it wherever found.

The Apple Maggot can be readily distinguished from the larva of the Codlin-moth by the absence of feet and the fact that it infests the pulp rather than the vicinity of the core. But there are other maggots which are associated with this species, and with the larva of the Codlin-moth also, which are not readily distinguished from the true Apple Maggot. These other species pertain to the genus *Drosophila*, and feed upon decaying fruit. They cannot be considered, therefore, under ordinary circumstances, as noxious insects in an orchard. Two species of this genius are described in the following articles, under the name of *Pomace Flies.*

THE VINE-LOVING POMACE-FLY.

(*Drosophila ampelophila*, Loew.)

Order *Diptera;* family *Drosophilidæ.*

(Plate VI.)

A small white maggot, found abundantly in decaying apples, and producing a small, clear-winged, red-eyed fly.

Comstock says : While studying the Apple Maggot (*Trypeta pomonella*) just described I found associated with it two kinds of smaller and more slender maggots, which, so far as my observations go, feed only on the decaying part of the apple, following the Apple Maggot in its work of destruction.

As these maggots are the young of flies which in all stages are very common about the refuse of cider-mills and fermenting vats of grape pomace, I have called them Pomace-Flies. And I have distinguished the two species studied by prefixing to that name in each case a translation of the specific name. Thus, one which bears the technical name *Drosophila ampelophila* may be known as the Vine-Loving Pomace-Fly ; and the other, which is *Drosophila amœna*, may be called the Pretty Pomace-Fly. I have preferred the term Pomace-Fly to a translation of the generic name, as being both shorter and more characteristic than "moisture-loving flies."

Although, under ordinary circumstances, the Pomace-Flies feed only on decaying fruit in an orchard, and cannot on this account be

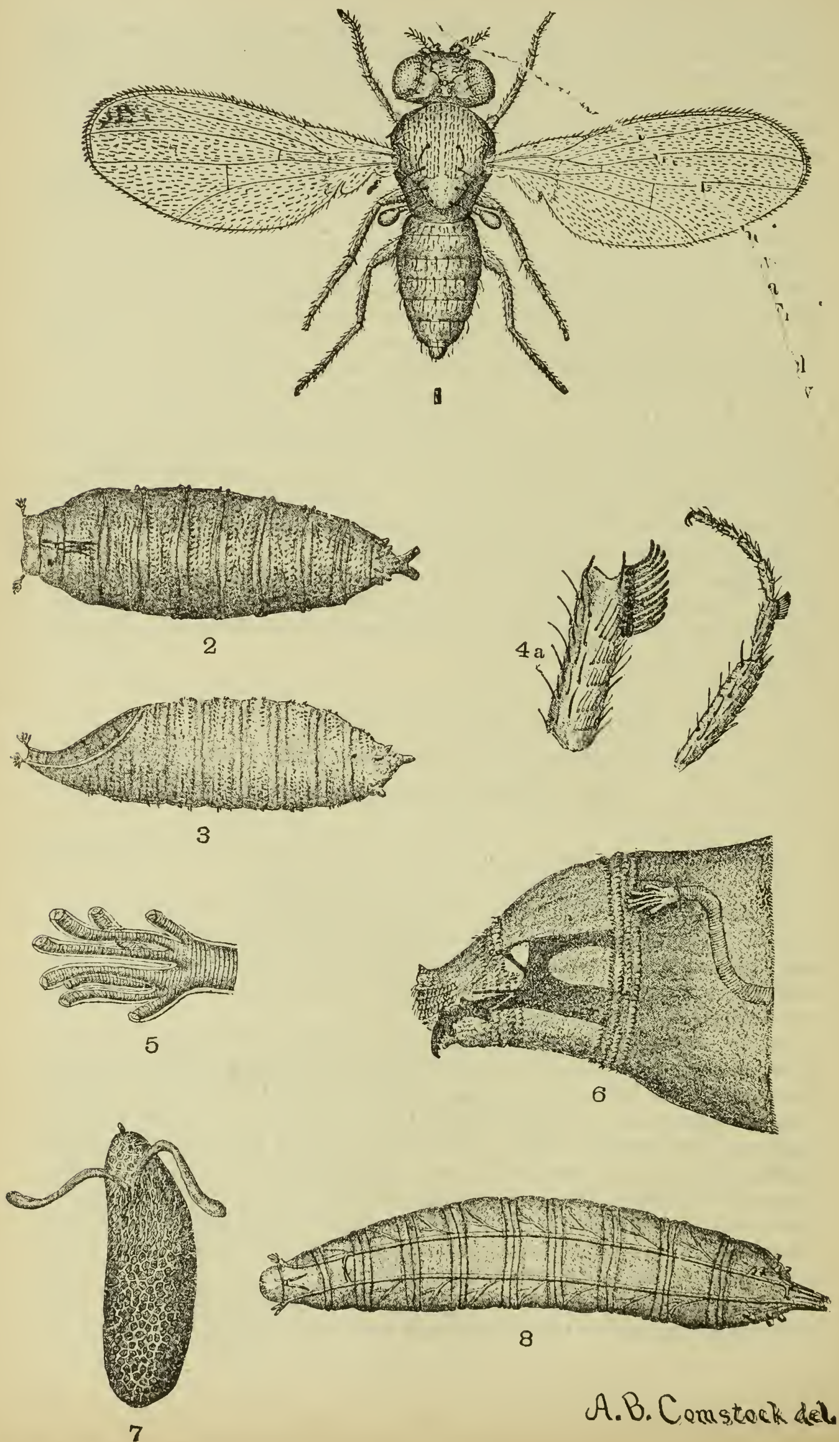


Plate VI.

considered as pests of the apple, there are cases in which they become quite noxious. They are, therefore, worthy of consideration in this place. Moreover, it is important that the Pomace-Flies should be described in connection with the Apple Maggot, as they are very liable to be mistaken for it; and a mistake of this kind might cause a fruit-grower a great deal of unnecessary trouble.

Mistakes of this kind in regard to these very insects have been made by entomologists of extended experience. I have, therefore, taken much pains to work out the specific characters of the different larvæ.

The Pomace-Flies may be found in any orchard during the autumn, flying about the rotten apples. And their larvæ may usually be seen feeding in great numbers in the decayed fruit. They go through their transformations very rapidly, so that there are several generations in a single season.

This rapidity of multiplication greatly increases the seriousness of the evil where this insect is a pest.

Upon Plate VI of this report are represented the various stages of the Vine-Loving Pomace-Fly. The more important characters presented by each are as follows:

Egg.—Figure 7 represents the egg, which is elongated in form and white in color. The most striking characteristic of it is a pair of long, slender appendages near the cephalic end. The egg is inserted into the soft pulp of the decaying fruit; these appendages leave the ovipositor last, and are spread out upon the surface of the mass. They in this way serve to keep the egg in place, and thus insure the emergence of the larva into the open air instead of into the more or less fluid mass in which the egg is situated. The larva issues from the egg just above the base of these appendages. The egg, without its appendages, is about $\frac{1}{5}^{mm}$ ($\frac{1}{50}$ inch) in length; the appendages are about three-fifths as long as the egg. The whole surface of the egg is facetted with cells, which, although irregular in outline, are usually pentagonal. Projecting from the cephalic end is a small tubercle, the micropyle.

Larva.—The larva is a slender white maggot, which, when full grown, is 4.5^{mm} (nearly $\frac{1}{5}$ inch) in length. The oral hooks and internal skeleton to which they are attached are visible to the unaided eye as a black line. The caudal part of the body usually appears brown; this color is due to the contents of the alimentary canal. The general form of the larva is represented by Figure 8 of Plate VI. It is widest near the middle, and tapers toward each end, but more towards the cephalic end than towards the caudal. The main tracheal trunks are visible with a low power of the microscope. The general arrangement of them is similar to that of the Apple Maggot. The important character by which this larva may be distinguished from the larva of the Pretty Pomace-Fly is the structure of the cephalic spiracles. One of these is represented, greatly enlarged, at Figure 5 of Plate VI. The main trachea divides into several, usually seven or eight, divisions. These divisions all arise from nearly the same point, and each one opens independently. This compound spiracle may be extended to quite a distance, as shown in Figure 8, or may be drawn

entirely within the mesothoracic segment; whereas it pertains to the prothoracic segment. The two caudal spiracles project backwards prominently. Each one consists of a brown tubercle, in which the tracheæ subdivide, and each division apparently opens separately. There are several semicircular tufts of bristles on each spiracle. These probably prevent the openings from being closed with foreign matters. A side view of this spiracle closely resembles a similar view of the corresponding spiracle of the larvæ of the Pretty Pomace-Fly. (See Plate VII, Figure 1*c*.) The caudal segment of the larva we are describing bears five pairs of blunt, rather short, tubercles. These are represented in Figure 8, Plate VI.

Pupa.—When the larva is full grown it changes to a pupa within or about the apple upon which it has fed, instead of going into the ground, as does the Apple Maggot. Like the Apple Maggot, this Pomace-Fly transforms within the dry skin of the larva. Consequently what we naturally see of the insect in this stage resembles somewhat the larva. It is, however, shorter, measuring only 3^{mm} (.12 inch) in length, but is much thicker. The cephalic spiracles and the tubercles of the caudal end of the body project conspicuously. There is a large concavity on the dorsal surface of the cephalic end. This indicates the point at which the adnlt fly emerges. On the ventral surface of the cephalic end may be seen the oral hooks of the larva.

Figure 2, Plate VI, represents the ventral aspect of puparium, and Figure 3 is a lateral view.

Adult.—The form of the adult is carefully represented by Figure 1, Plate VI. The head, thorax, and legs are light brown, with black bristles and hairs. The abdomen is very pale brownish-yellow; on the dorsal surface the caudal margin of each segment is dark brown, and in the male the entire dorsal surface of the two caudal segments is of the same color. The male of this species bears a remarkable comb-like appendage upon the first segment of the tarsus of each of the first pair of legs. The venation of the wings is carefully represented in the figure.

Remedies.—Doubtless much can be done to prevent the undue increase of these insects about cider-mills, wine-cellars, and similar places by keeping these places clean, and especially by using care to not leave any decaying fruit exposed. And possibly, also, by use of Carbolic acid, Kerosene, or other destructive or offensive preparations.

THE PRETTY POMACE-FLY.

(*Drosophila amœna*, Loew.)

Order *Diptera;* family *Drosophilidæ.*

(Plate VII.)

A small white maggot, resembling the larva of the Vine-Loving Pomace-Fly, and, like that species, found in decaying apples; but unlike that species in going into the ground to transform, and developing into a red-eyed fly with black spots on its wings.

Associated with the Vine-Loving Pomace-Fly I found another species belonging to the same genus, the *Drosophila amœna* of Loew. For this I propose the popular name of Pretty Pomace-Fly. This species I have not found as abundantly as *D. ampelophila;* but as it

is also associated with the Apple Maggot (*Trypeta*), it is liable to be mistaken for that species. I therefore present the following description of the different stages of it:

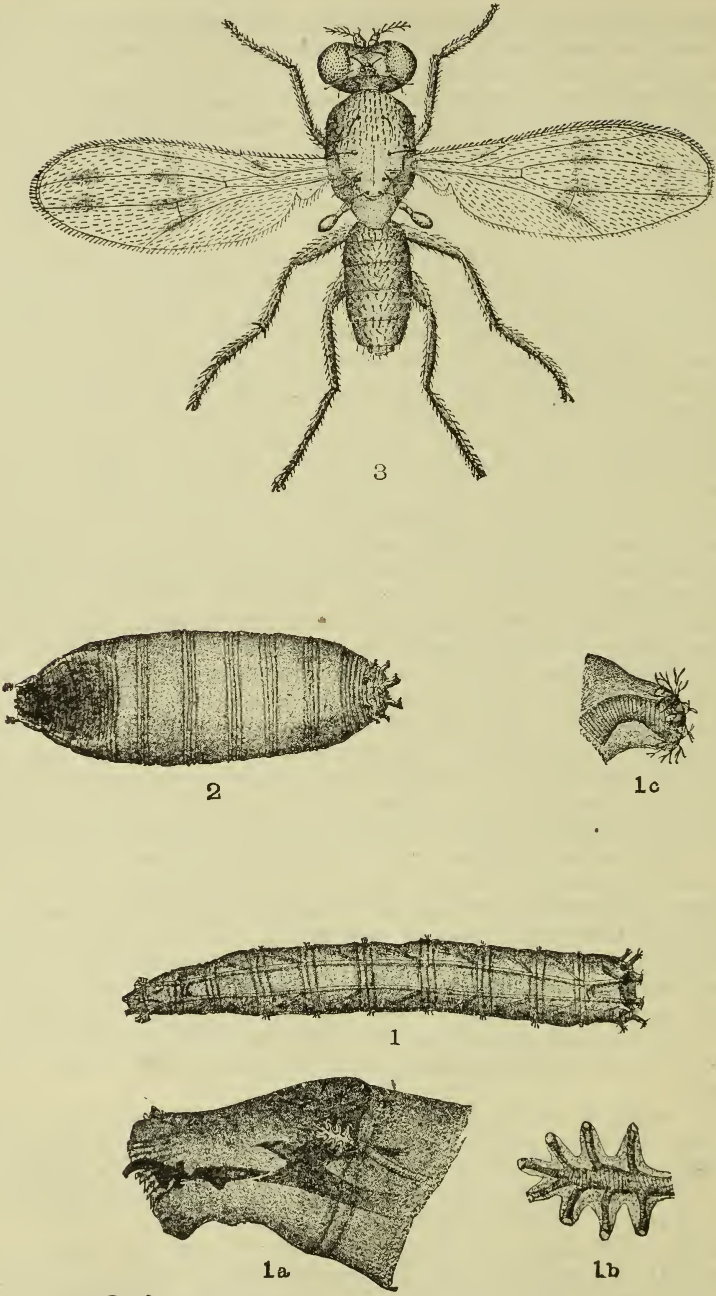
Egg.—Repeated efforts to find eggs of this species failed, although by imprisoning flies with apples we afterwards found larvæ on the apples, from which we bred adults of this species. Either we overlooked the eggs or the species is viviparous. At least, it is not probable that the eggs are as large and conspicuous as are the eggs of *D. ampelophila.*

Larva.—The larva of the Pretty Pomace-Fly is of the same length as that of the species just described (4.5^{mm}, nearly $\frac{1}{5}$ inch), but it is much more slender. The form of the body is cylindrical, tapering slightly toward the head. (See Plate VII, Figure 1). The body is white; the oral hooks and the skeleton to which they are attached show as a black line to the unaided eye. The form of these organs is represented in Figure 1*a*, Plate VII. The hooks are not conspicuously toothed, as in *D. ampelophila*, and the framework to which they are attached is more elongated than in that species. The main tracheæ are plainly visible with a low power of the microscope, as with the two species already described; and, as with those species, the most obvious specific character presented by the larva is the form of the first pair of spiracles. These project from the cephalic margin of the first thoracic segment, or may be withdrawn within the segment. Each consists of seven or eight divisions of the tracheæ, which branch off in a series on each of the two opposite sides. (Plate VII, Figure 1*b*.) The two main tracheæ are each terminated by a spiracle at the caudal end of the body. A side view of one of these spiracles is given at Figure 1*c*. The tracheæ divides into several branches, each branch opening separately. There are several semicircular tufts of bristles on each spiracle. These probably prevent the openings from being obstructed with dirt. The caudal segment is truncated, and bears eight fleshy tubercles, the two longest of which are situated lateral of the caudal spiracles. Each of these tubercles is tipped with several hairs; only six tubercles are visible from above.

Pupa.—When full grown the larvæ enter the ground to transform, differing in this respect from *D. ampelophila.* My experiments seem to indicate that this species must necessarily go into the ground. From apples thickly infested with the larvæ of both species, but placed in a jar without sand, I was able to breed only *D. ampelophila.* But after the same apples, still containing larvæ of both, were transferred to a jar containing sand the adult forms of both species were reared.

The length of the puparium is 3^{mm} (.12 inch); color brown; the cephalic spiracles project directly cephalad; the caudal spiracles diverge. The puparium of this species may be identified by the structure of the cephalic spiracles described above. For general form of this stage, see Plate VII, Figure 2.

Adult.—The adult of this species is represented by Figure 3 of Plate VII. As compared with *D. ampelophila*, the body is more slender, the head relatively larger, and the wings are marked with black spots. The flies have the habit of flapping their wings at short and



A. B. Comstock del.

Plate VII.

regular intervals. The periods of this species are longer than those of *D. ampelophila*, as it requires a month or more for it to pass through all its stages.

Remedies.—In case the Pretty Pomace-Fly becomes troublesome, the same course of treatment that is recommended for the Vine-Loving Pomace-Fly will serve to keep it in check.

THE OCCELLATE LEAF GALL OF RED MAPLE.

(*Sciara ocellaris*, O. S.)

Order *Diptera;* family *Mycetophilidæ.*

(Plate VIII.)

On the leaves of the red maple (*Acer rubrum*) circular ocellate spots about three-eighths inch in diameter, with disk yellow, and margin and central dot, during one stage of their growth, cherry-red.

The foliage of red maple (*Acer rubrum*) is often seriously injured by certain very small larvæ, which make large and very conspicuous spots or galls upon it. This insect is apparently widely distributed. It occurs so abundantly that I have repeatedly seen trees every leaf of which was infested.

This insect is so small that of itself it would not readily attract attention, but the result of its work is so conspicuous that it may be seen from a long distance. This appears in the form of a circular spot three-tenths to three-eighths inch in diameter, which at a certain period of its growth is light yellow in color, with a cherry-red margin and central dot. (See Plate VIII, Figure 1.) At other periods the spot is simply light green or yellow. Frequently these spots occur so thickly as to intersect each other and to completely cover the leaf, fifty or more being on a single leaf. At the center of each spot may be seen, on the upper side of the leaf, an elevated portion. Corresponding to this, on the lower surface of the leaf, there is a pit, within which the larva lives. Larvæ that were partially grown were found to be held in place in the pit in the leaf by what appeared to be a larval skin. This pellicle covers the body entirely, and is with difficulty removed from it; the edges of the pellicle adhere quite tightly to the leaf. When the larva is full grown it forces itself from under this skin, which then falls back into the cavity, or is pushed to one side, where frequently it may be seen adhering to the leaf. The larva at this time drops to the ground, into which it enters to undergo its transformation.

The larvæ are translucent, viscid, nearly colorless. Those in the galls are broad oval (see Plate VIII, Figure 3); but those which have left them are more elongated, tapering almost equally towards each end. On the lateral margin of each abdominal segment there are one or more short spines, which are directed towards the caudal end of the body. And on the dorsal surface of each abdominal segment, near each lateral margin, there is a small tubular spiracle. There is a distinct head (see Plate VIII, Figure 3*a*), which bears short but conspicuous antennæ. The caudal end of the body (see Plate VIII, Figure 3*b*) bears a pair of fleshy appendages, each of which is furnished with a pair of spines similar to those on the margin of the segment, and a large number of triangular teeth.

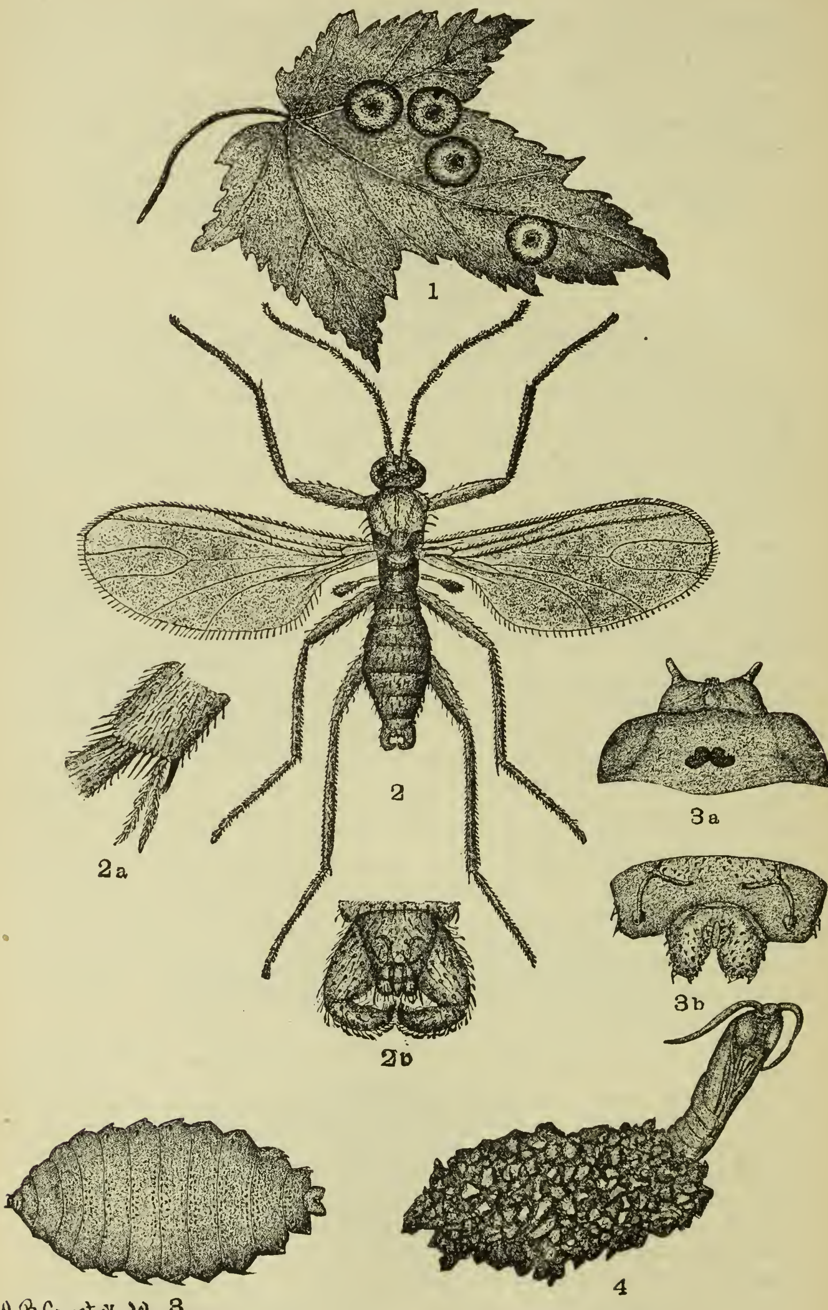


Plate VIII.

The larva spins something like a cocoon a short distance below the surface of the ground. To this cocoon the particles of sand firmly adhere, so that it can be distinguished from the soil only with difficulty. The pupa is yellowish-white, with large black eyes. When the pupa is about to transform to an adult it emerges for about two-thirds of its length from the the cocoon. The pupa skin remains firmly attached in this position (see Plate VIII, Figure 4.)

The galls made by this insect have long been known. Osten Sacken, from a study of the galls and the larva which he saw in them, proposed the name *Cecidomyia ocellaris* for the species, believing the insect to be a member of the *Cecidomyidæ.* But the fly which I have bred proves to belong to the genius *Sciara*, of the family *Mycetophilidæ.* This result is quite interesting, for the species of Sciara are usually found " among decaying leaves, in vegetable mould, in cow-dung, under the bark of dead trees, etc. One other species, (*Sciara tilicola*) is known to produce a gall. This species infests the leaves of young linden trees in shady, sheltered situations. The lemon-yellow larva, capable of leaping like the cheese-maggot, lives in numbers in the stem, generally near the origin of the last or of the two last leaves. Each of them has a hollow of its own, and produces a swelling of the size of a pea, which it abandons before the transformation.

Description of adult male.—Plate VIII, Figure 2. Head dark. Eyes black, kidney-shaped, and meeting in a point on the dorsal surface of the head, Antennæ sixteen-jointed, inserted close together; color dark brown, with the basal segment light yellowish-brown. Epicraninm quite large and convex; dark brown, bearing three ocelli, which are whitish and glistening. Pronotum light yellowish-brown. Mesoscutum arched, yellowish-brown in the center and darker at the edges. Scutellum dusky brown. Metathorax dark brown, almost black. Abdomen, with caudal portions of segments blackish, the cephalic portions yellowish-brown. The claspers lighter brown. Poisers, with knob blackish, and base light brown. Tibiæ and tarsi dusky brown; femora lighter; coxæ still lighter. The distal end of each tibia furnished with two long brownish hairy brushes (Plate VIII, Figure 2*a*).

THE CLOVER LEAF BEETLE.

(*Phytonomus punctatus*, Fabr.)

Order *Coleoptera;* family *Curculionidæ.*

(Plate IX.)

HABITS OF THE GENUS.*

During the few years another European insect has made its appearance in the role of an enemy to an important branch of American agriculture. This insect—the *Phytonomus punctatus* of Fabricius—has been well known in Europe for almost a century, but has never done any serious damage to crops. Yet so common is it there that almost every one entomologically inclined who has traveled through Germany or France has doubtless found it under sticks or stones in pastures and meadows.

*Compiled from United States Agricultural Report of 1881-2.

In looking up the literature on the habits of the insects of this genus in Europe, we find much written on the history of the earlier states of several species. From what is known in Europe, it appears that the species of the genus show a variety of habit and mode of development. The greenish larvæ (recalling in general appearance those of Syrphus or certain Tenthredinid larvæ) feed in May or June on the leaves and flowers of the plants they infest, and spin in July a net-like cocoon on various parts of the plant, changing therein to pupæ within eight or twelve days, the beetle issuing in July or August. Only one annular generation is recorded—the beetle hibernating.

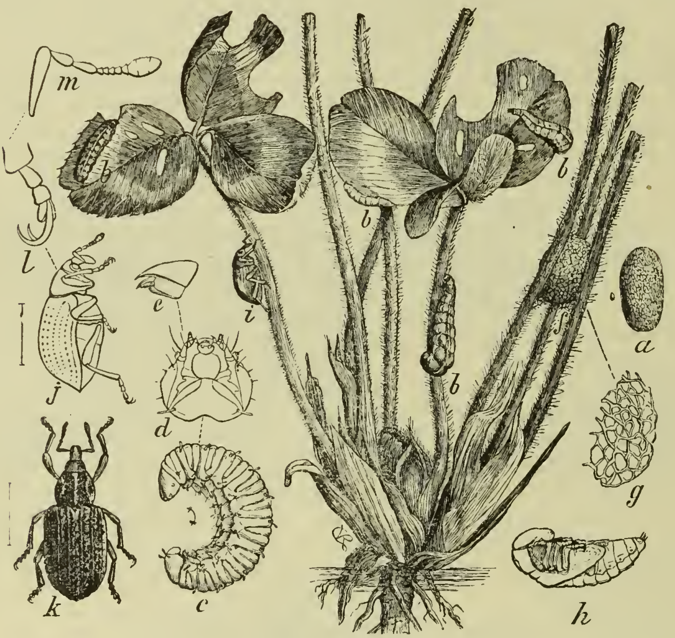


Plate IX.

So far as heretofore known the habits of the genus in this country conform to the above experience in Europe.

Our attention was first called to this insect by letter from Mr. L. D. Snook of Barrington, Yates County, New York, in July, 1881, stating that great damage was being done to the clover on his farm. In the latter part of April he first noticed on a field of clover, here and there, small patches where the leaves were badly eaten. The damage increased rapidly in extent, and by the end of July the whole field (about seven acres) was badly infested, one corner of nearly two acres having scarcely a whole leaf of clover remaining. Other fields in the same neighborhood were attacked in the same manner, while an occasional field escaped injury.

We visited Mr. Snook in August of 1881, and found acres of his clover ruined, but in passing through his field none but an expert

would suspect the cause, since the beetles were, as a rule, hiding in the ground or slightly beneath the surface, and the few that were feeding dropped and "played 'possum" upon the slightest approach, their color being so nearly that of the earth that they are not easily observed. That they had been much more numerous earlier in the season then they were then was apparent from the number of dead specimens, more or less broken, and from the cocoons imbedded in the ground. No traces of eggs, larvæ, or pupæ were found, though many empty cocoons were obtained either on the surface of the ground or imbedded just in the ground, as we then supposed, from the pattering of rain. None were found upon the plants.

In June of the present year we sent Mr. E. A. Schwarz to Barrington to look after the progress of the pest. His report shows an alarming state of affairs in Yates county, the insect having spread in all directions.

Since last fall numerous experiments in rearing this insect have been carried on, and from the notes, as well as from this year's observations in the field, we are enabled to give the following

LIFE-HISTORY OF THE SPECIES.

The smooth, greenish-yellow, oval eggs are deposited by the female beetle in irregular clusters, mostly in the hollow leaf-stems or flower-stalks, where such situations can easily be found, or they are pushed into crevices near the base of the plant. In confinement the females lay their eggs promiscuously upon the glass and wood work of the breeding-cages, or upon almost any part of the plant given them for food. When deposited upon a plane surface, however, they are not firmly attached and are easily removed, which argues that their natural location is in some crack or hollow.

The newly-hatched larvæ are pale yellow in color, and feed preferably upon the under side of the leaves, or between the young leaves before these get separated, eating small, round holes. While feeding the body is somewhat curved and the larvæ evidently hold to the hairs of the leaf by the folds between the joints of the body, as they are entirely legless. As they increase in size they acquire a greenish tinge, the broad dorsal strip alone remaining whitish. A few of them, however, retain the pale-yellowish color throughout their development. After the third molt they feed at the sides of the leaf, eating out large irregular patches, as shown in our figure. (Plate IX, Figure *b*.) The shape of the larvæ at this time is also so well indicated at *b* and *c* as to need no further description. The whole length of the larval life in the breeding-cage varies from forty days in summer to several months in winter and fall.

Only the very young larvæ can be observed upon the plants, the older ones invariably dropping to the ground when approached. Most of the larvæ, however, do not feed on the plants during the daytime, but are to be found under all sorts of shelter in or on the ground, sometimes quite a distance from the plant, but preferably among the roots and old stalks. Here they lie curled up in a similar manner to our saw-fly larvæ or cut-worms. When handled they often eject, in a

long stream, their semi-fluid, pitchy-black excrements, probably as a means of defense. When teased they finally stretch out and walk off more rapidly than could be expected of a legless Curculionid larva. When crawling they not only use the ventral tubercles, which are very prominent, resembling legs without the claws, but they use also the head and anus in a very peculiar manner. The head is pressed downward until the front touches the ground. The body is thus stretched forward as much as possible when the anus leaves its hold, quickly following the rest of the body and taking a firm hold near the head. The larva then stretches itself out, and the same movements are repeated. The anus evidently plays an important part in the locomotion; it is somewhat extensile, and each time the larva uses it to take hold of the leaf a small drop of a sticky fluid is ejected. The anus seems also to possess the power of suction as the larvæ are capable of erecting themselves so as to look around for some object to take hold of, turning, at the same time, their bodies in all directions and holding solely by the anal end.

Toward evening the larvæ begin to be more active and ascend the plant, undoubtedly continuing to feed throughout the night. However, even at dusk they do not become less timid than at daytime, and can only be observed upon the plants at a considerable distance, curling up and dropping down when approached. Their favorite position is with their bodies around the edge of a leaf, but more rarely one may be seen stretched out on the surface of a leaf.

The damage done by the larvæ in the month of June was already quite considerable, the presence of four or five half-grown ones being sufficient to give the plant a ragged appearance, and in some places where the plants were completely defoliated, not less than thirty-two larvæ were counted under one plant, which was not a very large one.

After feeding for from ten to fifteen days, having suffered three molts, the larva commences to spin its cocoon. The cocoon is oval, pale yellow in color, and is composed of coarse threads forming an irregular net-work, as shown at *f* and *g* in the figure. In the breeding-cages (during the winter of 1881–'82) it was usually spun between two or more leaves or leaf-stalks and attached to them. This is in accord with what is recorded on the subject by European writers, but all the old cocoons we found in 1881 were either on or in the ground, and Mr. Schwarz found them in June, 1882, invariably under ground, *i. e.*, so completely covered up with soil that in clearing away all *debris* no trace of them could be discovered from above. Usually they were just covered with the soil, but in some instances they were more than half an inch in the ground, each cocoon lying in a nicely smoothened cavity. This habit, though different from the known habits of other species of the genus, is undoubtedly normal wtih *punctatus* in the field.

In spinning among leaves the abdomen bends under, and the larva is thus able to brace itself with two points against the fastened leaves, whereby the head and front portion of the body can be easily moved in every direction; it then touches with its mouth the leaf, applying at the same time a drop of a transparent, pale-yellowish liquid, which is stretched out to a thread until the next point is reached with the

mouth. In this way it continues for some time, and then turns the body in another direction, and works in the same way until a nearly oval cell is formed; when this is done it fills up the space between the meshes more and more, and the cocoon becomes more regular. It then follows the different threads with its mouth to strengthen them with additional applications, and at the same time fills up the two large spaces till the cocoon is quite compact, leaving only small, round, or oval holes through which the larva is but indistinctly seen. The spinning of the cocoon lasts for about one day, when the larva ceases to work and remains lying in a more or less curved position until it finally casts its last skin to transform to a pupa.

I have given the extended account of this insect on account of the many inquiries in this state in relation to it, and the fear that it may do us material injury, yet I trust such will not be.

Remedies.—It is impossible to say whether or not this Phytonomus will spread farther. The encouraging presumption, however, is, if we may predicate upon analogy, that it will not, since we recall no very injurious beetle introduced from Europe (excluding those feeding upon stored products) which has spread over the whole country, the most prominent examples of such introduced species, *Crioceris asparagi*, *Galeruca*, *xanthomelæna*, etc., being yet confined to the Atlantic coast.

Our experience and observations during the winter show that this Phytonomus hibernates principally in the young larva state, and that any mode of winter warfare that would crush or burn these larvæ hibernating in the old stalks would materially reduce the depredations of the species the ensuing summer. Clover stubble is, however, not so easily burned in winter, and whether rolling could be advantageously employed will depend very much on the smoothness of the field and other conditions.

The extreme timidity of the larva as well as of the beetle, and the protected position of the insect in all stages render the application of pyrethrum, or any other remedy acting upon contact, entirely useless. To poison the clover with London purple or Paris green would no doubt be effective, but can be safely applied only wherever the clover is not used for fodder.

Should the Phytonomus be very bad in a field, it would be well to plow the clover under rather than to allow such field to become a source of contagion. This should be done in the month of May, when the insect is mostly in the larva state, and when all eggs from the beetles that hibernated have been hatched. To plow the field when the Phytonomus is in the imago state would have no other effect than to disperse the beetles over other fields.

THE VAGABOND CRAMBUS.

(*Crambus vulgivagellus*, Clem.)

Order *Lepidoptera;* family *Crambidæ.*

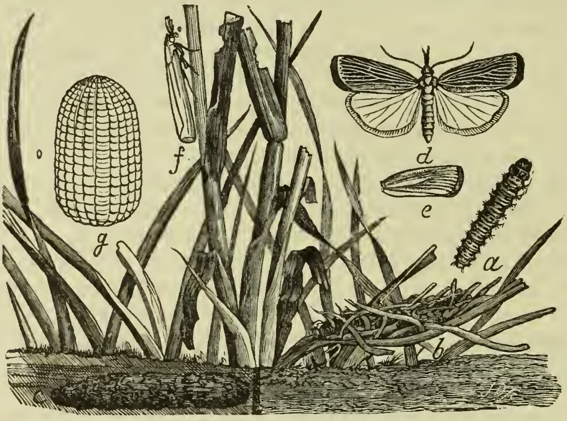


Plate X.

HISTORY OF ITS INJURY AND IDENTICATION.

Early in May, 1881, considerable damage was done to meadows in the vicinity of Watertown, Jefferson County, New York, by an insect which was popularly thought to be the Army Worm. In 1882 this extended into Vermont, and hundreds of acres were injured by the pest, and it was found in all the New England states as well as New York.

HABITS AND NATURAL HISTORY.

The eggs are difficult to find, as they are dropped singly by the moth wherever she happens to rest, and the slightest jar causes them to fall into some crack or crevice. The larvæ, if not too numerous, are also difficult to find, on account of their nocturnal habits, but more particularly from time of hatching to the assumption of the pupa state they remain nearly in the same spot. The newly-hatched larva spins a delicate white web, near or among the roots of the grass, and commences at once to feed upon the softer parts of some leaf near at hand, or bore through its surrounding sheaths into the stem itself, near its base. Whenever they have settled they protect themselves by a delicate web, which they gradually cover with their greenish frass, forming a tube, in which they are entirely hidden from view. They are very sluggish, and, if the tube be disturbed, curl up into a helix-like roll. As they increase in size the tube is extended either upward, when upon the ground, or downward, if somewhat above the surface, and the opening is often lined with bits of green grass. When the larva is full grown its tube measures, often, nearly 50^{mm} (two inches) in length. A half inch at the lower end is thicker than the rest, is rounded and closed, serving both as a retreat for the larva and

as a receptacle for excrement. The upper or open end is usually very delicate, and is generally so constructed that if the larva is disturbed and moves downward it closes entirely.

When full-grown and ready to transform, the larva leaves its tube and commences to spin among the roots, and near or just beneath the surface of the ground, an elongate club-shaped cocoon, similar in appearance to the lower end of the larval tube. It is composed of smooth and delicate white silk, gummed over with earth. Both ends are rounded, the thicker end being about 6^{mm} in diameter, and the narrower end about 4^{mm}. In this cocoon the larva remains for a long time before transforming.

Naturally the moth is rather shy if disturbed, though as a rule it will not fly very far, and when at rest may be approached quite closely. It seems to prefer dry stems or leaves of grass or weeds when alighting, and it is very difficult to detect in such situations, owing to the similarity of its color to that of the object upon which it rests. It swoops suddenly to the ground when startled, but does not feign death, as do so many allied insects. Instead, it slips, with a peculiar gliding motion, under the dry leaves or other objects upon the surface of the ground, or even makes its way into cracks of the soil.

The number in which these worms must have appeared to do the damage reported is enormous. Some pasture lots of forty acres were entirely ruined, and as many as a dozen worms were often found in a space as big as the palm of a man's hand.

In some sections the injury from this insect has been great. The Canadian Entomologist says: "Hundreds of acres of grass presented a brown appearance, as if they had been winter-killed. A pasture lot of fifty acres, which ten days before offered good pasture, was apparently burned, so that in places not a blade of grass could be seen to the square yard. Numerous dead caterpillars were adhering to the dead stems of last year's grass, which it was believed had fallen victims to starvation. The upland pastures were first attacked. The progress was remarkably rapid; entire fields were laid waste in ten or twelve days."

Last year there were greatly decreased numbers, and it is hoped this pest will be subdued by man's friends, the predacious insects.

Remedies.—Burning over the land in the fall or late summer is the only remedy that suggests itself, yet we hope that our insect friends will prevent such need.

INDIAN CORN AND ITS CULTIVATION.

By Hon. E. M. Goodwin, Member of Board.

A more wonderful plant has never been brought under cultivation by man. From the ripened kernel to the full grown and mature stalk, with the "full corn in the ear," it is full of wonder, mystery and promise.

Its origin still remains somewhat in doubt, though reasonably presumptive to be American, first becoming known in cultivation by the aborigines who inhabited this continent upon its discovery by Columbus, who found them using a bread of maize or corn, and it was among the gifts he brought back from the New World and presented to his royal patron, Queen Isabella.

It has never been found growing in a wild condition in any portion of the globe. Like most of the cultivated cereals, there is no wild progenitor known, although a few botanists have been inclined to regard the variety known as Rocky Mountain corn, each grain of which is enveloped in a separate husk, as the ancestral species. That variety is now known to soon lose this characteristic by cultivation. Herr Roezl, a German botanist, at one time a resident of Mexico, claims that he found in the state of Guerrero, a zea which he thinks specifically different from Indian corn and undescribed. If this statement be true, it is the only wild zea known, and the only wild plant known that we may consider as a possible progenitor of cultivated corn. But no other botanist, whose writings I have consulted, mentions having met with this zea, or wild plant. Mr. C. R. Orcutt, now resident of San Diego, Cal., who has made extended explorations and is familiar with the flora of all that region, does not signify in our correspondence that he has been able to find a trace of Roezl's zea, or any wild plant belonging to that species.

All our knowledge of the plant is derived from cultivated varieties, all of which doubtless constitute but a single species, which had already been so long in cultivation by the aborigines of this country, when it first became known to Europeans that all of the principal varieties which we now know were already in existence, except sweet corn, which has originated at a comparatively late period. It was not known in New England prior to 1779, when a few ears, says a writer in the Plymouth paper, were brought to Plymouth from the region of the Susquehanna river, by a soldier in Gen. Sullivan's expedition against the six nations, and was described as having a white shriveled grain when ripe, with a red cob, and called "pa-poon corn." But not till within a few years, however, has it been generally cultivated for culinary purposes. As late as 1828 only one variety is mentioned among garden vegetables by Thourburn, but in 1881 he mentions sixteen varieties.

The first attempt at cultivation by the Europeans was made on the banks of James river in 1608, or the year immediately following the Jamestown settlement. Somewhat later, when our Pilgrim Fathers had settled in New England, guided by instructions received from the natives, says Gov. Bradford in his history of the Plymouth colonies, they planted the first corn ever planted in New England by civilized man.

The flexibility of its organization is truly wonderful, readily adapting itself to almost every variety of soil and climate, so that we find it thoroughly "domesticated" and growing to perfection in the humid valleys of the Amazon, on the high and arid plains of Mexico, throughout the region of the United States, and in the provinces of Canada; and in points of elevation, from the level of the sea to the height of seven thousand feet above it, thus occupying a wider range of latitude and elevation than any other cereal, an infinitely wise and beneficent provision of the Eternal Goodness, as no other product of the earth contributes so largely to the sum total of food for man and beast.

Its most northern limit of cultivation, however, is confined to a region of country ranging across the continent from east to west, with a summer temperature of sixty-five degrees above zero for about three months in the year, bounded by a curved or isothermal line, beginning near the forty-fifth parallel of latitude, in the state of Maine, descending to the forty-fourth, about the region of the White Mountains, in crossing the state of New Hampshire, where it rises abruptly up to the forty-seventh, at a point near Quebec; then descending to the forty-sixth in crossing New York, and still further on, as we encounter the cooling influences of the great lakes to the forty-fifth, which it follows pretty closely to near the Minnesota line, when it rises up to the fiftieth about the region of Lake Winnepeg, terminating practically at the forty-third parallel of longitude west from Washington. It is, however, essentially a tropical plant, very sensitive to frost, delighting in a season of high temperature and sunny skies, yet attains its greatest production in a temperate climate, and a region of cold winters, where the mean annual temperature ranges from forty-five to sixty degrees above zero, but the mid summer reaches a mean temperature of seventy to eighty degrees, and with a proper distribution of rain. Every one has noticed the rapid growth and development of corn during "dog-days," when those hot waves pass over the country, accompanied by frequent showers of rain sufficient to supply the rapidly growing and luxuriant crop with moisture without making the soil actually wet.

A large number of varieties (various collections numbering one and two hundred, that of Dr. E. Lewis Sturtevant more than three hundred) are known and cultivated. They have come, differing in size, shape, color, texture and composition, and varying in growth from three to eighteen feet in height, through long and varied modes of cultivation and climatic influences from a single species, and may be classed in two families—the Flint and Dent,—but more practically the small and the large, requiring a summer temperature for a period of time, ranging, as between the extremes of the families, from sixty to two hundred and twenty days for maturing the crop.

As a rule, the higher the elevation and the higher the latitude of the location, the smaller the variety that can be grown; therefore, in selecting a variety to plant we should first consider the elevation and the latitude of our location, although each locality will impart to a new variety introduced a character adapted to its soil and climate.

Yet, while we would have in the one case to check the growth and shorten the time of maturing, which is attended with uncertainty, and frequently with disappointment, in the other case we could stimulate the growth and prolong the period for maturing, and which is enhanced by the characteristics of the variety introduced, having been developed in a climate of a shorter period of high temperature; hence attended with success. So if we desire to change our seed we had better select a variety from a more *northern* rather than from a more *southern* locality. And in the great corn growing districts the opinion prevails that seed brought from the westward rather than from the eastward, is attended with the best results.

It has been a common experience with corn that a change of seed is less often attended with an increase of crops than is the case with the other cereals. Why change seed? There is no necessity for it, as a variety may be grown in the same locality for all time, by the exercise of care and skill in the cultivation, intensifying the stamina and character—in common phrase making it thorough-bred.

A brief allusion to the botanical structure of corn will afford a more intelligent understanding of some of the methods practiced for combining and developing the desirable characteristics of the varieties in cultivation.

The flowers are of two kinds, male and female. Those borne on the branching panicle or tassel, are male flowers, and always appear two or three days before the female flowers that are borne on the bunch of filaments called the silks, as the pollen of the male flowers requires the aid of air and light to perfect it, while the female flowers are fully developed when they appear. At this time the pollen which has already begun to fall off drops upon the silks which proceed directly from the ovules of the rudimentary kernels, and thus fertilization is perfected.

The full corn in the ear is so dependent upon the mutual service of these organs, that if either one is removed or destroyed, the fruiting of the ear is sure to fail.

As nature is ever generous, so here she dispenses with a liberal hand, bestowing a superabundance of pollen which is borne promiscuously about on the wings of every breeze, producing evidently nature's design, cross fertilization, it is rarely that the silks of a stalk appear until the tassel of the same is in perfection. Two varieties can not be grown in close proximity without each being affected by the other, although the product of each might not show like or equal change. While one might show very marked change in size, or shape, or color, the other might not show any visible change whatever. Yet the texture and internal structure might be found upon examination to be changed to a considerable degree.

The changes produced by pollen may extend to all or only to part of the ear, as shown by the parti-colored kernels on the same cob which exhibit the general color of the parent variety. Moreover, ears are occasionally found with the kernels on one side of the cob, differing entirely in shape and general appearance from those on the other side, —another illustration of admixture by pollen.

This seems to be a general law of nature that inbreeding shall not take place in the cereals, so according to the Darwinian theory dependence can be put upon " the survival of the fittest" for perpetuating the variety in all its characteristics.

Now, if each of two varieties possess qualities desired in one, they are planted together, and so soon as the tassels appear in the variety upon which it is purposed to engraft the qualities sought in the other, remove them ; then the female flowers—*the silks*—of the decapitated variety will be fertilized by the male flowers—*pollen*—of the entire variety ; and the product will possess the combined characteristics of its parents in a greater or lesser degree. For example : if it is sought to transmit the characteristic of large kernel of some variety to the variety having the characteristic of long cob, the two are planted together, and as soon as the tassels of the variety with the long cob appear, remove them, and the female flowers—(*the silks*)—of this variety will be fertilized by the male flowers—(*pollen*)—of the variety having the large kernel, and the product will be found to have taken on somewhat a new character that becomes a part of its being, and through the old biological law, " each yielding seed after its kind," this new character is transmitted to the next issue or growth.

Again : the stalks are of two kinds, perfect and imperfect. The one bearing the tassel only is imperfect, never yielding any corn. The other bearing both tassel and silk is perfect, and capable of reproducing itself. These are very suggestive facts, and should be constantly borne in mind by all who are laboring to improve their corn. If, therefore, you would go through your fields and remove every tassel from all imperfect stalks as soon as they appear, the productive capacity would be largely increased. It is, however, more expedient and worthy of practice to grow seed corn on a plot set apart for that special purpose, where attention could be given to every detail in removing unfavorable influences to the growing of seed with improved qualities, and increased and still increasing strength to reproduce its own kind.

Upon this point Professor Blount of Colorado Agricultural College, remarks : " The stalk can be made larger or smaller, shorter or longer ; the cob can be lessened and the grain on it increased ; its color changed to suit the taste ; the ear and shank shortened or lengthened ; single or many ears on the stalk, and a hundred more changes can be wrought if the farmer has the inclination and patience to give it his attention."

I am fully persuaded that none of us yet begin to know all there is to be learned in regard to improving corn. The main points for us to observe, however, are those that cover the rules to make a more abundant yield in a shorter time, a better quality and at less expense. We must make more careful research, observation, and experiments.

In selecting a variety for general cultivation, one of fine growth of stalks, with the ears well down on the stalk, and growing closely to them on short spikes, yielding a fairly average crop and ripening off fully every year, is to be preferred to one with tall, heavy growth of fodder and large ears, requiring the full length of season to mature fully. All the larger varieties have proportionately larger leaf surface, clearly indicating that they require a correspondingly larger amount of moisture. The analysis of the corn plant in the different stages of its growth teaches a significant lesson upon this point. It shows that during the time of growth about eighty to ninety per cent. of the entire plant is water. If so, then it follows that a more liberal supply of water is required by the larger than by the smaller varieties; consequently through want of moisture, and especially during the last stages of growth, although the corn may appear dry and hard at harvest, it will be be deficient in starch, fibrine, and especially sugar—the essential elements of nutrition.

As to eight or ten rowed varieties to be preferred, I heartily sympathize with public opinion as expressed by seventy-five of every one hundred farmers throughout Vermont in growing eight-rowed varieties. This popular verdict is well founded in reason; eight-rowed varieties will yield a larger amount of shelled corn to a given amount of stalks than will twelve-rowed; eight-rowed varieties will yield a larger amount of shelled corn in proportion to the amount of cob than will twelve rowed, and the eight-rowed varieties can be grown more closely in row, and more closely in the row than twelve-rowed varieties. And the fodder from the former is more valuable for cattle than from the latter, as having less woody fiber or indigestible matter.

Preparing the ground thoroughly has much to do with making the crop profitable or unprofitable. The seed-bed should be made fine and mellow. If on sod land, the plowing should be done the fall previous, about seven inches deep, avoiding all "balks" and shallow or uneven furrows, then left to the action of the frost, a wonderful agent in disintegrating the soil and making it light and friable.

During the autumn, or at any convenient time, even in winter, when snow covers the land, draw and spread upon the field from three to five cords of stable manure, according to the fertility of the soil. If supplemented with a commercial fertilizer, somewhat less will be required. And I know no better fertilizer for this purpose than acid phosphate—*dissolved bone*, or one compounded of finely ground bone and hard wood ashes, in the following proportion: one barrel of ground bone to three barrels of ashes, thoroughly mixed and wet with ten or twelve gallons of water prepared some little time before using. This amount of fertilizing material is sufficient to produce a fairly average crop of corn. This practice of lighter manuring and often, with a thorough cultivation, is more profitable than that pursued by many of heavy manuring, with the expectation that it will answer for three or four successive crops. Frequent tillage, in these days of gang plows, disk pulverizers and sulky cultivators, is not attended with the labor and inconvenience of the days of strapped plows, spike-toothed harrows and hand hoes, and it is becoming the rule of practice with enterprising, progressive farmers.

Drawing and spreading the manure in winter time lessens the total expense of production, by doing this work when the team is having a comparative leisure season, and labor attainable at two-thirds the price of season wages. It possesses another advantage over old methods in having the fertilizing elements dissolved out by the melting snow and spring rains, to be absorbed by the soil and held in readiness to feed the roots of the young plants, and stimulate them to early and rapid growth. An experience of a score of years in applying manure in various ways for raising corn, watching and noting the results, while no one of all these practices appears to be absolutely and entirely the best in all circumstances, yet I have come to adopt the practice of applying manure fresh from the stables during the winter season. And after having used commercial fertilizers alone for growing the crop, and that, too, with success, I would recommend their use, if at all, in connection with stable manure, as giving the most satisfactory results.

I have practiced hill manuring, have noted the results of the practice by others, have made inquiry, have read the testimony of such men as John Johnson, George Geddes, T. S. Gold and E. Lewis Sturtevant, all of which has led me to broadcasting manure.

Dr. Sturtevant says: "It appears quite probable that the same manure spread around the corn hill, instead of being placed in it would have a larger influence upon the growth."

J. R. Nichols, who has had large experience in raising corn, says fertilizers are better sown broadcast than applied in hills or drills.

If you dig about a corn hill, at any period of its later growth, the greater part of its feeding roots will be found away from the hill, extending to a distance of several feet. This range of roots is not purposeless, but a provision whereby the strong growing plant gathers its food from a large surface. Does not this suggest broadcasting manure?

What is nature's process? She applies all fertilizers to the surface. The very elements exert their greatest power upon the surface—the rain, the snow, the frost, the light, the solar heat; to the surface falls all decaying vegetable matter and the excrements of animal life. Would man reverse her law?

I have known many farmers to pass from hill manuring to broadcast manuring, but I have never known a farmer to change his practice from broadcast manuring to hill manuring after once having given a fair trial.* I have never been able to find the roots from corn planted upon hill manuring remaining in the manure, or, after passing beyond it, turning back to feed upon it, but extending and widening through the soil until it becomes filled with a perfect net work of rootlets. So if the fertilizing material is scattered through the soil it will be where it can be readily and more fully appropriated than if collected beneath the main roots, which are more the prolongations of the stem or stalk beneath the ground than true roots. You, who have examined the soil of a corn field in the season of full growth, well understand how completely the rootlets have invested it, not a square inch but what has been pierced through and through.

*See Dr. Sturtevant's writings.

In the spring, as early as the ground becomes sufficiently dry to be worked (and this is a most important point in the tillage of all soils), the manure, which has been broken down and pulverized by the frost, is thoroughly incorporated with the soil by the use of a disk cultivator, after which a light smoothing harrow is run over the field when it is ready for planting.

Just before planting I find it advantageous and economical with all, to line off the land into rows with a marker for the purpose. The horse with the planter can be guided by the lining more easily than without it, securing a straighter row, which makes the work of the cultivator far more effective than with irregular or crooked rows. My rows are three and one-half feet apart, with the hills two feet apart. But the planter drills the seed eight or ten inches in the hill. The truck wheel of the planter depresses the soil an inch or two below the general surface and compresses it about the seed. This pressure is not only a benefit to the germinating of the seed, but also in the first harrowing of the field after planting, especially if that be done just before, or at the time the young plants prick through the ground, as the harrow passes over the track of the planter without disturbing them in the seed bed. By the time of second harrowing they have become sufficiently strong to withstand any disturbance the harrow will make in passing. After this, the cultivator, adjusted to the width of the rows (as they were lined off evenly), is run between them as often as is necessary to keep down the weeds, or the condition of the crop demands. Since frequent stirring the soil promotes the circulation of air and the development of moisture through it, which aids the growth of the corn, the use of the cultivator is continued till the growth covers the ground or the tassels are well out, when all cultivation ceases, except, perhaps, the cutting out with the hand hoe of what weeds chanced to escape the cultivator. Here the crop is left to mature.

As soon as the kernels begin to glaze, and an occasional ear with white husks can be seen scattered through the field, cutting up begins. I have tried various ways of cutting up, but prefer to cut an armful, then relax somewhat my hold, letting the stalks rest upon the ground, twist a stalk round the bundle, which will now stand firmly up. Then cut and set around the bundles till you have a shock of convenient size; bend over the top and bind down with any material for a band, the cattail flag answering every purpose. This binding the tops down is very essential in keeping out the storm and protecting the fodder while in the field.

I begin husking as soon as the corn is dry and the fodder cured off so it will not be injured by packing in the mow, securing the crop as fast as my conveniences for housing will allow, to prevent the fodder from becoming injured by rain and storms, which are frequent at this season of the year. As the husking goes on, seed ears are saved, if they have not been grown as before described, preferring those from stalks bearing more than one ear, and with well formed kernels, closely set in the rows, which should be straight throughout from butt to tip, and compactly arranged around a small cylindrical cob, rejecting all those with large butts having a larger number of rows here than elsewhere on the ear, and all those with confused or irregular rows. The

ears thus selected should be "traced up" and hung away to dry, secure from moisture and mice.

Selecting seed ears from among those ripening first never secures the largest, fullest, truest, types of the variety cultivated. It has no other tendency than that of reducing the stalk and shortening the time of maturing. The veteran farmer of Geneva, N. Y., who practiced this method, in summing up the results obtained, expressed an opinion corroborating this statement. Whoever pursues the practice, carefully noting the changes produced, and their probable causes, will come to the same conclusion I am fully persuaded.

For planting, the kernels from all parts of the ear are used, giving uniformly as good results in regard to an abundant yield, and the full development of the crop as any other practice. The experiment of planting kernels from different parts of the ear has been repeatedly tried, giving very uniform results, perhaps somewhat better from those taken from the tips than otherwise, when there was any very appreciable difference. In one experiment, followed up for ten years, the results, as reported by a well known agricultural writer, stood as seven to three in favor of those taken from the tips. A series of experiments conducted at an experiment station, resulted in showing that no practical advantage was obtained from using the kernels from any one part of those from any other part of the ear. Sufficient has been shown by intelligent experimentation to prove the practice of rejecting the kernels from the tips, which prevails generally throughout the country, to be without good cause, and wanting every other support than that of traditional custom, and should be done away by every intelligent farmer.

I regard corn, with the exception perhaps of grass, the most profitable crop the farmer can grow. While we cannot compete with the West in quantity, we can produce it at a cost far below the price of Western corn in any of our markets. Yet, Vermont produces only about two million of the five million bushels consumed; less than one half by several thousand, indeed by more than one million bushels, of the total consnmption.

It is said by chronic fault-finders, and shiftless unthrifty farmers, that corn cannot be raised in Vermont profitably—that it cannot be raised as cheaply as we can purchase Western corn. To all these, and those who sympathize with them, I beg to submit for their consideration the following account of two crops raised by myself, in which every item of expense is noted except interest and taxes on land:

FIRST TRIAL OF ONE ACRE MADE IN 1878.		DR.
To five cords of manure		$20 00
Plowing and fitting		3 50
Planting		50
Tilling		3 00
Cutting		2 00
Husking		3 00
Cribbing		1 50
One-fourth bushel of seed corn		50
		$34 00
SAID ACRE.	CR.	
By lot corn fodder	$10 00	
Fifty bushels shelled corn at forty-eight cents per bushel	24 00	
		$34 00

This crop cost forty-eight cents per bushel, about forty cents below the market price of corn at the time.

SECOND TRIAL OF ONE ACRE IN 1879. DR.

To one-fourth ton Bradley's Fertilizer		$11 50
One hundred and fifty pounds Muriate of Potash		3 00
Fifty pounds Sulphate of Ammonia		4 00
Plowing, tilling, and harvesting as in the previous case		14 00
		$32 50
SAID ACRE.	CR.	
By lot corn fodder	$10 00	
Forty-eight bushels of shelled corn at forty-seven cents per bushel	22 56	
		$32 56

This gave me corn at forty-seven cents per bushel, leaving a liberal margin of profit for raising.

These two crops were raised as per account on fairly average corn land, such as you and many other farmers possess, and can be done by whomsoever will make the effort, as well as by myself. At all events, an average crop of from forty to fifty bushels of shelled corn per acre, can be raised if good tillage is given the crop. And I am fully persuaded from later experience with improved machinery and improved methods of cultivation, it can be raised at a less cost per bushel than was expressed in the before cited trials.

If Vermont farmers would grow upon an average two acres more than is now grown, producing only the average yield per acre (thirty-two bushels) for Vermont, the production would fully supply the consumption. But at the present time we are sending out of the state two million dollars annually—six dollars per capita for her entire population—for corn alone, to say nothing of the large sums paid for bran, middlings, cotton and linseed meal. Are those not startling figures? True, nevertheless.

But is there no remedy for this state of things? no way by which to supply the demand for this cereal so readily and so profitably raised in almost all parts of the state without such an enormous expenditure of money abroad which should remain at home?

Let each farmer set himself to the task of improvement by enlarging his present acreage, improving his cultivation, thereby increasing the crop, that it may equal the demand.

THE FARMER'S SOCIAL POSITION.

By Hon. E. M. Goodwin, Member of the Board.

A right to social equality is guaranteed to every American citizen. There is no caste with us or distinction that attaches by being of plebian or patrician birth, all being born equal. It is possible for any one to rise, even from unprotected self-dependence to public confidence and honorable position. No circumstances of birth are a bar to this. Though born in the humblest of abodes, they can, under the influence of our institutions, acquire all the training necessary to qualify them for holding responsible trusts, and occupying the highest position in the gift of the people. There are no obstacles in their path which talent and well directed effort cannot overcome. Whatever occupation they may choose, whether it be one of the professions, or whether they engage in trade, or manufactures, or farming, it is possible for them to attain to the highest degree of excellence and make their influence felt.

The farmer's occupation requires manual labor. His hands are often hardened with necessary toil, and his brow tanned with the burning heat of the noon-day sun, but that does not degrade him, nor is it considered derogatory to the highest style of manhood to be found engaged in any useful manual labor, notwithstanding that sentiment to the contrary, which is entertained by the few who still sympathize with clanship and aristocratic notions. And whatever of this feeling there may be among us is passing away. The time is coming, and the dawn of that day now is, when the advocate and participant of manual labor will find his position far higher in the world's estimation than the indolent and non-advocate. For what a perversion of terms, or rather what a perversion of moral sentiment, does it exhibit to talk of the dignity of indolence, the dignity of doing nothing, and the unworthiness of useful, honest labor. We are beginning to learn that the conquest over the earth and the multiplication of its products are acceptable sights in the eyes of God and man. And he who puts his hands to the plow and does not look back upon more brilliant, but less useful, employments will not fail to find his reward in a happy and honorable life. The mention of special example is not necessary to establish this premise. Yet there are in the history of our own Green Mountain state such worthy examples. I cannot forego the pleasure of recounting, in this connection, the names of Jarvis, Hammond, Hill, Cushing, Campbell, men who were farmers, and have risen from their humble abodes to gain distinction for themselves, leaving behind a more exalted and enduring reputation than any that heraldic inscription or wealth can give.

It is laid down by some writer as a position not to be controverted that the agricultural people in this country constitute the basis of our

social and political system. And well he might, for they include fully two-thirds of the entire population. From their ranks spring the majority of the most successful among those engaged in the various other occupations of life. In short there can be no other class of our population which affords so safe a source on which to rely for an infusion of new life into each and every pursuit to the durable prosperity of our social and political system as the agricultural.

Notwithstanding all this, there is a tendency on the part of the young to get away from the farm. Alas! why do they not retain

> "That fond attachment to the well known place
> Where they started into life's long race,
> Which keeps its hold with such unfailing sway,
> We feel it e'en in age at our last day."

What lures them from the homestead which has been built and preserved by the labor of their fathers, and is surrounded by those confortsw which only home, sweet home, can give. Can there be anything about social life in the country that has a tendency to produce this inclination in the minds of the young upon the farm? There is, I fear, in many instances, a lack of fellowship, a want of companionship among farmers and their families. The great evil that besets the life of those who dwell in rural districts is isolation. Farmers live comparatively alone. In a great measure they have been debarred the social privileges which are easily obtained by those who live in villages. This isolation is contrary to nature. There is with every one a desire for companionship. And this is especially true with the young, so that they who dwell upon the farm, not finding the desired condition of things at home, or in the limited society with which their parents mingle, are inclined to seek for it elsewhere, and thus are led away from home and the farm. The lamentable fact that the young are leaving the farms in Vermont may be verified by the observations of any one. While the total population of the state remains nearly the same, the large villages are increasing in size, the farm districts are depopulating, and most of those who are left are men and women past the middle age of life. Their sons, as they have arrived at early manhood, have left the farm to seek their fortune in some other vocation, and with the rush by sea and land have drifted to the great centers of population, consequently there is less of social life in the homes among the hills; and those homes in many parts of the state are being deserted and destroyed.

There is a prejudice even more injurious and fatal than that which I have named. The farmer's son is averse to his father's calling. He does not intend to pursue it, and is always looking for some way by which to escape from it. This prejudice is hereditary in the farm-house. The farmer himself is not content with his occupation, nor is the farmer's wife any more so. They regard it as a humble, laborious, toilsome one; they continually fret about its privations and hardships, and thus they raise, unconsciously, perhaps, in the minds of their children, a disgust for it. Is not this frequently so? Is there not before me a farmer or two who is seeking or desiring, to say the least, to find for his son a desk in some telegraph office, a chair in some village physician's study, a place behind the counter in some drug shop, or a

clerkship in some country store, in preference to training him to the labors of the farm.

The homes of any community are an index of the thrift, education and refinement of that community. Show me the homes of a neighborhood, and I will tell you of the condition of society there; for the home is the basis of society, upon that the whole fabric rests. Contaminate the home and all else is destroyed, for it is here that our youth receive their first impressions, and form their habits, which are life enduring. Though corruption may sometimes find a lodge in high places, yet if our youth of the country, as they leave the domestic hearth and go forth to take part in public affairs, are educated in the principles of pure morality, and trained to observe by practice the gracious promise made by God to man, "By the sweat of thy brow shalt thou eat bread," society is safe. Then it follows, as farmers constitute a majority of the citizens, that the prosperity of our country and the duration of its institutions depend, in a great degree, upon the condition of our rural homes, and the social position of their occupants.

As equality is the leading idea of social life, the young who are reared on the farm and induced to remain there must be assured in the belief that their opportunities for social life and culture will be equal to those of their companions who may have gone, either from inclination or force of circumstances, into other employments.

I believe one of the strongest reasons why so many of the young leave the farm is the fear that their social position will be below, or inferior to, that of some who are now their associates and equals. As a means of disabusing the young of this idea, and as a help towards showing the fallcay of such reasoning, farm life must be made attractive; the homes and surroundings should be made as beautiful as the circumstances of the owners will permit. Lavish expenditure of money is not necessary, for fruits will yield as bountifully, flowers grow as luxuriantly, music and adornment please as heartily in the home of the farmer as in the more pretentious mansion of the millionaire. Within doors, taste and comfort must be displayed and the means of culture and refinement provided; books and works of art should abound. Beecher says: "No man has a right to bring up his children without surrounding them with books. He cheats them. It is a wrong to his family if he does not. The love of knowledge comes with reading and grows upon it. And the love of knowledge, in a young mind, is almost a warranty against the inferior excitement of passion and vice."

Such of the farmer's sons and daughters who are to be the farmers and farmers' wives of the future must not only be trained in well regulated and pleasant homes, but in addition to this, if they wish to fill their social position in such a manner as to bring credit upon themselves and add dignity to their profession, they must receive the benefit of the best educational privileges which our industrial schools can afford. It is gratifying to know that attention is beginning to be paid to this kind of instruction in our country; that schools are projected where the best methods of rural art, and every branch of farm work will be taught experimentally, scientifically and practically. In

these institutions the labors of the field and the workshop will be followed by the lessons of the school room. Thus practice and science will be combined and familiarized, and the agricultural pupil will become the intelligent and accomplished farmer.

Let me commend the institutions to your favor, brother farmers, for the education of your sons. While I recommend these higher schools to your favorable consideration, let me urge and entreat you, to guard the common school with solicitude and jealous care. And while I would not say one word derogatory to what may be called with propriety the higher branches of learning, which are fit and commendable in their places, let me plead for a more thorough, intimate acquaintance with the more useful and practical, which involve the various branches of natural science. I hope and pray for a deliverence from the popular notion, so ghostly thin, that places so much stress upon the necessity of having the rudiments of these higher branches taught in the common school, often to the detriment of those that are so directly and intimately connected with the every day work of the agriculturist. Do not forget that the common school is the only school which many a youth will ever have the advantage of attending; and take care that all their courses of study are not planned with reference to further pursuit in the higher schools, and finally to a classical course in college. To compel our sons to a preparation in branches of learning that they will never afterwards prosecute is a waste of time which should be devoted to acquiring knowledge that will give an intellectual character to the labors on the farm and in the farmhouse.

The great weakness of the farmer heretofore has consisted in his defective education—in an almost criminal indifference to educating himself and family up to that high standard which comports with the dignity of a profession. The education of the farmer is the great thing needed. He must keep pace with those in other pursuits, and thinking men in the profession are waking up to this necessity. The old idea held by many that it required but little knowledge to make a successful farmer is giving way to the better opinion that industry and thrift will follow mental culture as surely as seed time is succeeded by harvest.

It is claimed by theorists that intellectual culture is not compatible with the hard manual labor required upon the farm. I can only say that labor is no more hindrance to mental refinement than it is to social equality. It is true that he who digs and delves continuously, never seeking for culture, will never find it. While labor does not degrade, ignorance does; hence, equality of social position must, in a great degree, be the result of equality of mental culture. Whatever the occupation, there should be a desire for improvement, for without this desire there never can be much progress in the right direction. To this rule farmers are no exception, and if the present condition of the agricultural class is not in every respect all that could be wished, the means of improvement are with themselves. As water seeks its level, so each individual or body of men may attain to the position for which they are fitted, if they will but make the necessary effort. Farmers, as a class, are endowed with sound and well-balanced minds,

and if in any deegree they fail in the exercise of brain power, it is not from want of natural ability, but rather from want of study and the practice of those arts that train and qualify them to cope with an opponent in the defence of equal rights and social equality. They need to rise from this night of slothfulness and ignorance into the light of knowledge and its power, and the first progressive step is taken in realizing this need, and in becoming conscious that intellectual culture is of benefit to them as well as to everybody else. But how is it to be obtained? There are means of culture and improvement open to those who are no longer young, and the old adage, "It is never too late to learn," well applies here.

The farmer, if he would better his condition and occupy the highest rank socially, and be a man and citizen equal to the best, must learn from every source. He must cultivate a habit of observation, he must profit by the observation of others, as embodied in their writings and teachings. He cannot wait to remedy the difficulty by educating the rising generation, but apply himself to the task of securing the desired results, directing his energies with all the zeal and spirit which characterize the age. He must regard his profession with pride, and consider agriculture an art to be associated with and assisted and developed by scientific inquiry and research. Between the systemized labors of the farm, he will find intervals of leisure sufficient not only for general reading, enough to give him all the information necessary for individual culture and social enjoyment, but for acquiring a very thorough knowledge of those branches of science so intimately connected with agriculture, like botany, which teaches him of the structure of plants, and how they grow; entomology, which acquaints him with the habits of insects injurious to vegetation, and how to prevent or remedy, so far as possible, their attacks; like chemistry, which will teach him of the composition of soils; to trace out their elements of fertility; how to explain the principles of their exhaustion and replenishment; which will teach him of the properties and nutritive value of different foods for his stock; what will supply the bone, what the muscle, what the fat. He should fully comprehend that what science, applied to a practical use, has done for other arts, it can do equally, and more, for agriculture. He must be neither a mere theorist, or a dull minded drudge, following the ruts made by his father's wheels, but a reading, reasoning, thinking, and with all, zealous student, ready to seize upon every new truth that can be appropriated to improving and *dignifying* his vocation, remembering that knowledge is power in agriculture as well as in every other pursuit of life.

A spirit of association pervades all other professions—the legal, the medical, the theological. It has created organizations for the mutual improvement and benefit of those connected therewith, and established regulations to be observed by members in the practice of their profession. Then why not avail ourselves of the same means for the mutual improvement and benefit of those who practice the profession of agriculture?

Since farmers do not put much confidence in the theories of mere book makers, but desire to see and hear those who would teach them, and have an opportunity, by listening and questioning, to form an

opinion of their capacity to teach them, farmer's clubs, where the many might be informed of what the few are doing who are successful, and where all might join in discussing some topic relating to moral affairs; and farmer's institutes conducted by competent and practical men, who through more and varied experience, and the adaptation of improved methods in farm husbandry, have achieved signal success, would afford efficient means for disseminating practical intelligence among the people. They would afford an opportunity for bringing men together bent on the same general object, an opportunity for meeting face to face, and talking over what they have common in interest; an opportunity for intercourse with other minds; an opportunity for comparing experiences, and enlisting the co-operation of individuals and families and whole communities in the work of building up and maintaining an honorable and influential position socially for the farmer. At these local meetings of practical farmers, the results of individual experiments should be brought together and compared; new discoveries in the art communities, erroneous opinions combatted and exposed, and higher and better knowledge of the theory and practice of farming secured. Because of the quiet nature of our employment and the isolation from the strife and turmoil of the marts of trade, the mind tends to grow or rather to remain dull and inactive. But stir us up, set our intellectual faculties into active operation at frequent intervals, and we become at once a thinking, reasoning, and progressive class of men; not only ready to learn from others, but competent to investigate and devise for ourselves. It is highly encouraging to witness the growing activity which is manifest in farmer's clubs, farmer's meetings, and social entertainments instituted among the rural population of our state. They are coming to be recognized as indispensable auxiliaries in promoting and disseminating agricultural science among the people. No doubt some faulty theories may be advocated, and impracticable methods recommended, but agitation and intelligent discussion will not fail to end in good.

A vocation like ours that engages so large a per cent. of the laboring class throughout the state, and is so enhanced by intelligent labor, needs that assistance beyond what private means can reasonably furnish. It requires the aid of that system of education which fits and prepares men for going among the people to disseminate that information which will expose error, and develops facts and principles of the highest practical utility in recuperating the exhausted fertility of our soil; that will build up an influential and honored agriculture; that will, with all, secure a more intelligent and refined society. The results would be seen in improved culture, better stock, better implements, better methods in using them, higher hopes, nobler efforts, more happy and contented homes.

It is not that we, as farmers, compared with others, are stupid and slothful that we have failed to receive that recognition in the administration of municipal affairs which our calling demands, but rather our listless indifference to the needs and capabilities of agriculture which has prevented that unity of sentiment and concerted action requisite to success.

We should not be legal food for other organized professions to feed upon without preparing to devour in return for self-protection. We can be just to others, at the same time be generous to ourselves, if we will but combine and work together for our interests as other professions do.

There should be no longer any delay in demanding from the common treasury the means for establishing and maintaining those seminaries of learning which will promote that system of education which our profession requires. It is for us to will, to do. We should no longer neglect to assert our rights, and appropriate that share to which we are entitled in the common patronage of the state, to the benefit of our vocation.

Shall there be, then, a working together among us—a lifting up of our social position and building up of our material interests, with a proper exercise of that influence which belongs to us, or will we let the world move on, as move it will, and leave us draggling behind, as nothing more than "hewers of wood and drawers of water."

GRASS.

By M. W. DAVIS, of Westminster, Member of the Board.

Cotton has been falsely called "King." When the two are compared "Cotton" dwindles into insignificance; beside of grass, it is no more than a word. One-sixth of all the plants on the globe belong to the grass family; two hundred and thirty genera, including three thousand species and more, already known; probably three-fifths of the cultivated land of Vermont is devoted to grass. The grass crop of the United States is estimated at three hundred and fifty million dollars. Hence the importance of the subject, though wantonly we walk over grass fields giving little credit to where credit belongs, for without cotton we could live, without wheat we could live, but without grass the world would be a desert, and man and beast would perish. History, sacred and profane, have not omitted in making many striking allusions to it. The psalmist and poet have made it typical of man's life.

"We are as the grass, springeth up in the morning and is cut down at evening."

"In the morning they are like grass which groweth."

"In the morning it flourisheth, and groweth up."

"In the evening it is cut down and withereth."

"All flesh is grass, and the goodliness thereof is as the flower of the field."

"The grass withereth, the flower fadeth."

"For all flesh is grass, and all the glory of man as the flower of grass."

Thus the psalmist in his inspiration and the divines in their exaltation of the ideality of man's nature, and the ennobling of his true life and destiny, have in these and many other immortalized sentences made the beautiful grass typical of human life. The "Great Florist" in unrolling the carpet of nature made the structure of beautiful green. This is in harmony with man's organism. Man's true spirit thereby is drawn out as nature's associate and companion, for he loves the beautiful lawn, the meadow green. When man artistically brings together the beauties of nature in floral blend in the park, garden or walk, he never forgets the beautiful grass. But what is grass? This may be more important to the botanist than to the farmer. But what farmer's son of ordinary intelligence would not like to be able to answer that question? How can he if he is never taught? For who has told him that clover is not grass, that Indian corn and sugar-cane do belong to the grass family as well as the cereals. Alluding to the importance of the farmer having some knowledge of at least the

names and classes of the plants he cultivates, I will say it is not my object to answer these questions so much as to urge the importance of the care and attention the Vermont farmer should give the cultivation of the grasses (including clover), as upon them he depends for winter forage for farm stock. For I believe this the central idea of all his movements in farm economy; all other products as farm crops should be subsidiary, guarding zealously every move, that directly, or indirectly, injures the grass crop. No country can be a prosperous agricultural country and import its hay. No country can long stand it and export hay largely, and what will apply to a country or community will apply to individuals. Vermont is truly an agricultural state, and ever must be, and her hope is in stock breeding and raising, and the value of her thirty-five thousand farms is as the amount of stock each will yearly carry, and as that capacity increases or diminishes, so Vermont agriculture changes. While we see so many once fertile lands now abandoned, yet Vermont is capable of supporting nine or ten times her present population. Why is it so? It is by neglecting this important crop. But how is the system to be changed? Clothe our barren hill-sides with forests, decrease the area of our cultivated crops, manure our meadows judiciously, even with commercial fertilizers, may be, in addition to compost manure, keep cattle, sheep and hogs, feed well and economically, and thus make them pay. The grass plant, unlike other plants, is not injured by the cutting of their herbage, except it be to excess. Very little is known of the natural or uncultivated grasses upon our farms. And among the many prevalent upon our soils, I shall speak of but few, and those only in a practical sense. I will notice

POA SCROTINA—Foul Meadow,

one of the earliest of grasses and among the best, and it should be extensively cultivated.

DACTYLIS GLOMERATA—Orchard grass. See Plate XI.

The relative value for feeding compared with timothy at ten dollars, is seven dollars eighteen cents; grows five feet high, and has yielded five tons one thousand eight hundred and fifty-nine pounds to the acre; it is recommended by some of the best farmers in the state for making good beef and milk. Stock like it; excellent to mix in seeding for pastures; it responds readily to high fertilization; finely adapted to the seeding of orchard land; hence its name.

POA PRATENSIS—Kentucky Blue grass. Plate XII.

Grows low; two and a half feet high, yielding one and a half tons to the acre. Butter, it is said, made from this grass will keep longer than from any other species.

It would seem a work of supererogation to argue as to the advantages of cultivating it. All know its benefits, and all see around them the great increase in the value of the land covered by it. It grows readily in all parts of the United States north of latitude forty degrees,

PLATE XI. *Dactylis Glomerata.* Orchard grass.

PLATE XII. *Poa Pratensis.* Kentucky blue grass.

and lower down on suitable soils. It flowers in the earliest summer, and gives rich pasturage. It varies in size in different localities according to soil and climate.

From the unexampled success its cultivation has met with in Kentucky it has acquired the name of Kentucky Blue grass, though in the New England States it is known by the name of June grass. In all the middle portions of the United States it forms the principal constituent of the turf, though its excellence is rather depreciated in the Eastern States. In some sections it has been used as a hay, but it is not a success as a meadow grass, its chief excellence being exhibited as a pasture grass. It endures the frosts of winter better than any other grass we have.

Proximate analysis of POA PRATENSIS—(June grass, Blue grass.)

	Per cent.
Oil	1.82
Wax	1.04
Sugars	9.61
Gum and dextrin	3.14
Cellulose	27.94
Amylaceous cellulose	22.53
Alkali extract	17.20
Albuminoids	11.54
Ash	5.18
	100.00

POA COMPRESSA—Wire grass, Blue grass. See Plate XIII.

This species has sometimes been confounded with the Kentucky Blue grass (*Poa pratensis*), from which it differs in many particulars. It is found in many old pastures, on dry banks, and in open woods.

The culms are hard and much flattened, one foot to eighteen inches long, more or less decumbent and bent at several of the lower joints. The leaves are scanty, smooth, short, and of a dark bluish, green color. The panicle is short and contracted, one to three inches long. The branches are in pairs or threes, short and rough, and frequently one-sided. The spikelets are ovate-oblong, flat, short-pedicled, and generally five to six flowered. The glumes are acute, three nerved, often tinged with purple.

The lower palets are three to five nerved, the lower part of the nerves finely hairy. At the base of the florets a delicate web of hairs is usually present.

This species may be distinguished from *Poa pratensis* by its flattened decumbent stems, shorter leaves, shorter and narrower panicle, with fewer branches. It forms a looser turf, but has a firm hold by means of its creeping rhizoma.

Very contradictory accounts have been given as to its agricultural value, some denouncing it as worthless and others speaking well of it. Hon. J. S. Gould says, respecting it:

It is certain that cows that feed upon it both in pasture and in hay give more milk and keep in better condition than when fed on any other grass. Horses fed on this hay will do as well as when fed on timothy hay and oats combined.

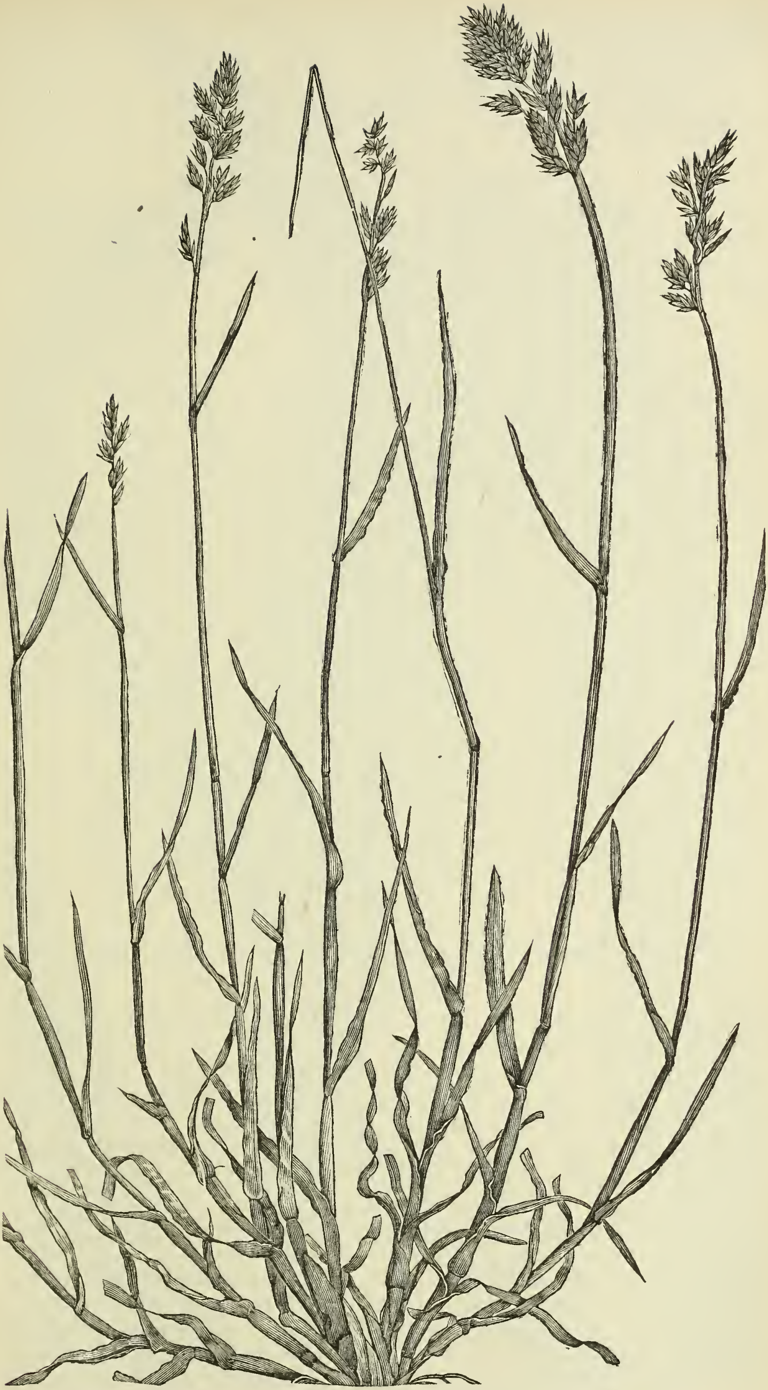


PLATE XIII. *Poa Compressa.* Wire grass, Blue grass.

AGROSTIS ALBA—(White Top.)

Grows upon sandy soil; of no great value.

AGROSTIS VULGARIS—(Red Top.)

A fine grass; very tenacious; enduring all climates, and adapted to most all soils, does well on moist soils where other grass is apt to run out, usually gains its supremacy when sown with other grasses, yet it is not advisable to mix it with other seed.

SETARIA GERMANICA—Hungarian Grass. See Plate XIV.

This grass was introduced into this country through the instrumentality of the United States Patent Office. It is a very worthy grass. I hold it in high esteem for the large burden to the acre, for its palatability to stock; milch cows have a great desire for it; it is milk producing and fat producing; matures quickly. J. W. Beardsley, Fairfield, Conn., says "in 1873, on eleven acres, he raised twenty-five tons." Another advantage is it can be sown after another crop of grass has been taken off, so help make up a short hay crop if desired, or if corn is a failure in June this grass can be sown at great advantage. Care should be taken in the curing for hay, and then all stock will do well upon it. I have sown it the fourth of July and had it mature finely; all that is necessary is to have it hayed before frost. It will grow in about two months. I sowed twenty-five quarts to the acre; this depends somewhat upon the soil, but it is not desirable to put it upon poor soil.

I learn through Dr. Cutting that great objection has been made, in some instances, to this grass, on account of the stiff bristles which surround the seed spikelets, and which are said to penetrate the stomach of cattle and cause inflammation and sometimes death. As I like it so well, I recommend the raising of it and cutting it before any danger can arise, or before the seed is mature.

TRITICUM REPENS (Botanical)—Couch Grass, Quack Grass, Plate XV.

or as we call it falsely, "Witch Grass." Indigenous on the arid plains of the West; here introduced. It made its advent in this locality about twenty-five years ago, when a man could hoe by hand, when cultivated out, two acres of corn daily; now upon the same soil, with the same cultivator used, the same willing hand as then could not hoe one-half acre a hay, if more than one-fourth, all on account of this so-called witch grass. Some have pronounced it the vilest of weeds, "Devil's Grass," etc.; others claiming for it high nutritive qualities for hay—quick in its growth, tenacious of life, enduring all climates and soils, overweighing all objections charged against it, it will stay. Twenty years ago, and subsequent, in the discussions had in the "Westminster farmers' club," while some of the best farmers claimed it the salvation of "Connecticut River farming," others present thought it would prove disastrous. For twenty-two years I have watched it with a great desire to keep an honest account with this grass, and

Plate XIV. *Setaria Germanica.* Hungarian grass.

PLATE XV. *Triticum Repens.* Couch grass, Quack grass.

I make it a debtor to me. It retards cultivation; if it gets into gravelly or stony soils, the farmer might as well surrender. If he has low land, which overflows and he wishes to keep to grass, there may be an advantage. It is not so disadvantageous to a corn crop, except in extra labor in cultivation, but destructive to the cereal, and the tubers of potatoes will be badgered by its roots. It will even completely pass through them. It makes good horse and stock hay, but not good for milk. One good thing may be said about it in these days of hired help; if in the field, they must keep moving, or it will grow through their boots and tie them to the ground.

There is one way to bring it into subjection, and if it is not thus kept it will often subdue the farmer. It is a warfare to annihilate it, and probably upon our feasible soils, when it gets in, it is not in the common rotation of farm crops advisable to extinguish it, as it is a substitute when other grasses fail to catch or winter kill, as this survives. Plowing after haying, frequent pulverizing and re-plowing, taking a steel tooth horse-rake, hauling the roots together, and taking them from the field, will very much thin it out, but there will be plenty left to retain its individuality. Still it has its virtues. It is perfectly cosmopolitan in its habits. It is found in all kinds of soils and climate.

There is a "Witch Grass" proper, (See Plate XVI), *Panicum capillare*. This is an annual grass, varying in height from six inches to two feet. It has a large terminal panicle which, when mature, is very diffuse, with long capillary branches. The leaves and sheaths are usually covered with long spreading hairs. It is very common in cultivated grounds, making its growth late in the summer, and after maturity the tops frequently break off and are blown about, and often accumulate in quantities in fence corners. It is mostly rejected by cattle, especially the very hairy forms. We give a figure of it chiefly for comparison, so that it may not be mistaken for a more valuable species. With the few I have now mentioned, as perhaps of secondary importance, and many more that are cultivated in this country that I might speak of, the grasses I would recommend as the staple varieties for most farms in Vermont would be Timothy or Herdsgrass, "*Phleum pretense*." First brought into cultivation in the state of Maryland, by Timothy Hanson, in 1720, and called "Timothy Hanson Grass;" finally Hanson was dropped and after called "Timothy Grass." The "Woburn experiments" in 1824 showed it possessed superior nutrient value. It has held its foremost rank among the grasses since that time and the hay stands first to day in the market, and in analysis for nutrient puposes, being the standard for all others to be compared with.

Trifolium Pratense—Red Clover,

dates from 1770. In 1773 James Vaux of Pennsylvania obtained a cask of seed from England which was injured on the voyage, and the subsequent disturbance between the colonies and mother country prevented the increase and distribution of clover until 1785.

I must ask the botanist to allow me to class it with the grasses, for my experience and observation endorses fully what George Gedds

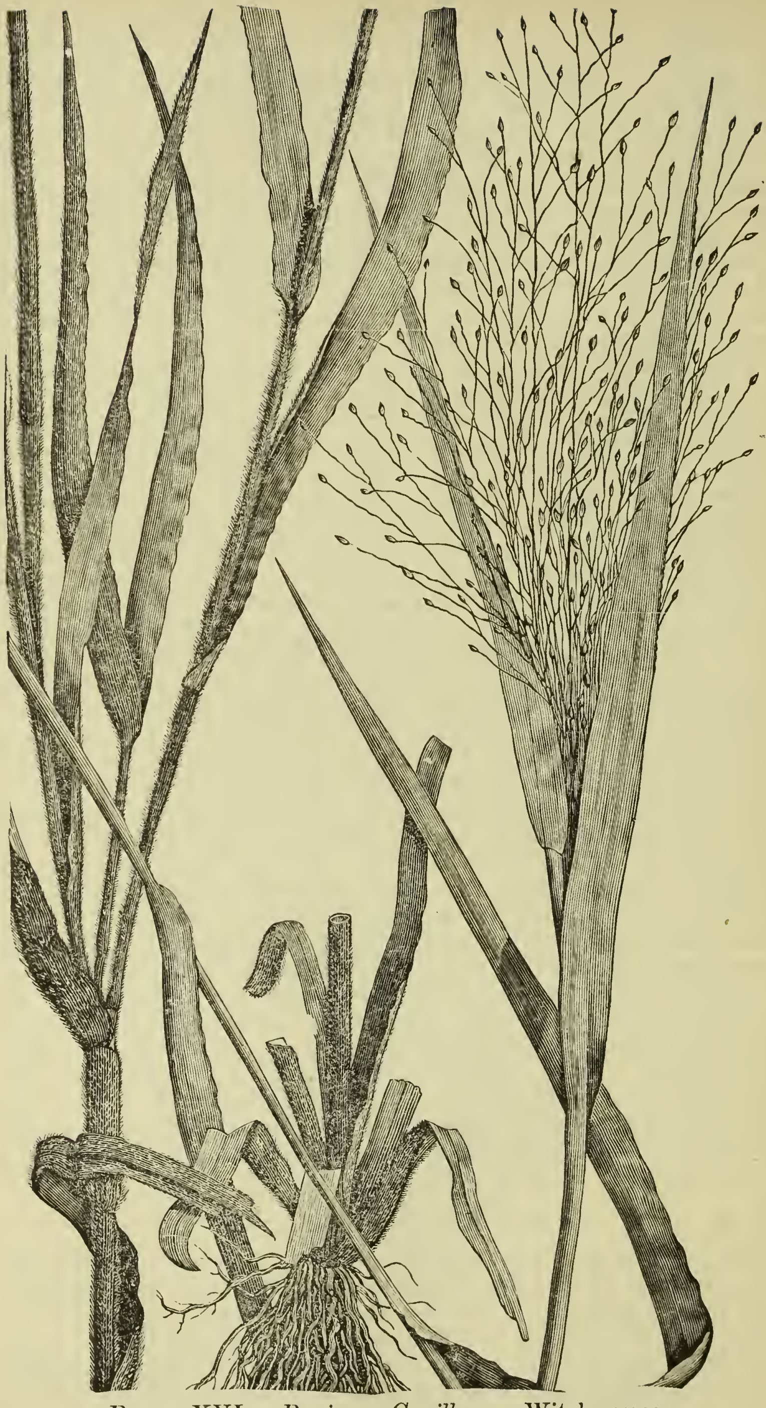


PLATE XVI. *Panicum Capillare.* Witch grass.

of Onondaga County, N. Y., said: "Strike this plant out of existence and a new revolution would follow in agriculture that would make it necessary for us to learn everything over in regard to the cultivation of our lands." Now before I proceed further let me say that it seems to me that the success of Vermont agriculture hinges upon the grass question. Oscar M. Leeber, state geologist of South Carolina, says the amount of grass shows the actual agricultural capacity of the state. He shows very clearly how a country that neglects grass culture will deteriorate, and we as Vermont farmers have this idea of the value of this farm crop ingrained in our being, but in some of our practice I fear it is too latent. Now in the purchase of a farm, very much of its value, depends upon how much stock it will keep, and this is our first enquiry. But what is desired in this effort is to impress the idea and fan it into a flame of enthusiasm, if possible, that two spears of grass can grow where but one now does.

I see by the United States statistics that Vermont records the most bushels of corn per acre, yet her record is most lamentable in her grass crop. The state produces but a trifle more than a ton to the acre of her mown lands. The Counties of Addison, Bennington, Essex, Orange, Rutland, Windham and Windsor produce less than a ton to the acre, while Caledonia, Chittenden, Franklin, Grand Isle, Lamoille, Orleans and Washington produce more, Franklin and Chittenden producing the most (some over 2,300 pounds). This ought not be so, and need not. Has the glory of timothy departed? We hope and believe not. The field of timothy in full blossom, standing erect, two and a half tons to the acre, is beautiful to look upon. While it needs much care in its cultivation, being a bulbous plant, forming a bud in early autumn to remain dormant, preparatory for the coming spring, therefore should not be over stimulated in the fall, by fertilization, to produce abnormal growth to die in winter, lessening the stand of plants, and making the grass thin; neither should it be feed with sheep or cattle too closely, producing the same result; neither too much aftermath should be left through the winter to produce heat or to invite the multiplicity of mice. Now in seeding land to grass the first requisite is a

RICHLY PREPARED SOIL.

The numerous seeds that will and should be applied will throw out their millions of little rootlets and must have, in their tenderness, a fine pulverized, fertile soil in order to establish themselves so as to resist drouth; therefore too much care and attention cannot be given to this work; thorough plowing when the soil is in right condition is necessary. If land is naturally a little heavy, plow in the fall previous to spring seeding, and sow as early as possible, to take advantage of the spring rain, that the young grasses may be firmly rooted before the summer drouths. Let me emphasize, by thorough plowing, thorough pulverizing, with the best implements in use crushing all the hard lumps of dirt, fitting it like unto an onion bed, made rich by the application of well-rotted manure incorporated through the soil. The next thing is

GOOD SEED.

And here is practiced upon the farmer downright robbery. Dealers in grass seed are too avaricious to sacrifice much, hence seed unsold one year is elevated to the next story, awaiting the return of another season, and then comes down and is mixed with new seed and sold. But a portion only vegetates, the farmers charging the failure to bad season, drouth, wind, covered too deep, or not deep enough, when in fact it is old seed, past ever vegetating, and the loss to that farmer is almost irreparable, causing disappointment in calculations, even changing his whole system of cultivation. The legislature, by legal enactment, should make it a penal offence for each and every vender of seeds to sell, or offer for sale any spurious seeds, from age or otherwise; that every salesman should test the vegetating power of the seed that he has for sale before offering the same to the farmer; and in addition to that, for his own safety, the farmer should make such test himself previous to using it; and in order to do so, place the seeds upon some moistened cotton batting or woolen cloth, put in a warm place, at a temperutnre of 75° Far. It will be sprouted in thirty-six to forty hours, and with a magnifying glass, costing fifty cents, he can tell what the proportion is that is good or bad. Next is

THE AMOUNT OF SEED TO BE SOWN.

It has been ascertained that in a square foot of rich old pasture land, composed of mixed grasses, there were one thousand plants, and some highly enriched and irrigated, two thousand plants. This is from seven to fourteen plants to a square inch. This is thick seeding, and with mixed seeds is undoubtedly advisable for pasture lands. Now let us see how many seeds there are in a bushel: In timothy 40,000,000, orchard grass 7,000,000, June grass 45,000,000, redtop 70,000,000, red clover 16,000,000, white clover 25,000,000. There are 6,272,640 square inches in an acre. Now, if we sow one peck of timothy (eleven pounds and one-fourth) and one peck of red clover (fifteen pounds), two pounds red top, and all vegetates, we shall have nearly eight seeds to a square inch, or eleven hundred and fifty-two to a square foot. If we sow a peck of timothy and a peck of clover, we get two and one-third seeds to a square inch, or three hundred to a square foot; so it may be at once seen that if seed is perfect, soil well prepared, and the planting properly done, the necessary amount of seed requisite would be much less than now paid for and used.

THE KIND OF SEED.

Every farmer must learn to judge well of the nature of his soil, the adaptation of the seed to the soil and climate; for every kind of grass has its natural home, and there may be, and probably is, upon the same farm the home of several varieties, and this is a scientific point for every farmer to continuously study, that the application may be judiciously made.

TIME AND MANNER OF SEEDING.

No arbitrary rule can be laid down in reference to this point. The judgment will be called to aid. Spring time is more generally prefer-

red, and the earlier the better, after the soil is capable of being handled. Sow with a good machine, if one can be obtained, for the work can be so much more perfectly done, avoiding wind, which often troubles hand sowing. Never sow until the seed bed is ready, and then cover lightly with a "Thomas smoothing harrow," or something like it, and on most land use a roller afterward. Whether to seed with grain or not, and the kind, is practically unsettled. That different cereals affect differently the succeeding hay crop is evident; some, while they equally well stand up free from lodge, take from the soil requisite constituents that seem to be needed as plant food for the grass. Oats are a bad crop to seed with, unless cut for fodder before ripe, so as not to rob the soil so much of phosphate in the maturing of the grain. Barley, wheat or rye are good crops to seed with.

Another way to be recommended is, when a corn crop is grown, to seed the last time of hoeing among the corn; this crop well prepares the land for this purpose if well tilled, it being necessary of course to practice flat culture that the surface may be smooth for mowing. A fine crop of grass will be produced the next season.

SUMMER OR FALL SEEDING.

The best piece of grass I ever mowed was a field a little bound out that I plowed in August; rolled it, put on fifteen loads fine manure to the acre. I sowed a mixture of herdsgrass, clover and red top. Then rolled it. If such sowing is late in the fall, the clover may be omitted until spring, and then sow on the last snows if convenient.

How shall land continually in grass be kept producing well? If capable of being plowed, treat it as I have indicated above occasionally, believing that the decomposition of the old sod furnishes the finest plant food for the propagation of the new grass. But if incapable of being plowed, a top dressing with even small amount of manure, yearly applied in late fall, winter or early spring, will be well. It may be judicious to apply a little seed also; this practice will be of but little avail if neglected until the grass is much run out.

How shall wet land be treated? Get rid of the surplus water by draining; then if too moist to plow, surface manure and seed. I once had a piece of mow land made so wet from springs coming out from the hill that it bore nothing but "frog's hair and cat-tail flag." A team could not be driven over much of it, but by running an open ditch along near the hill, and a parallel taking the water, putting fifteen loads fine rotted manure upon the acre, in the spring; at the same time sowing eight pounds clover and eight of timothy to the acre; the following season I cut two tons of excellent herdsgrass and clover to the acre. Now all of the general principles here alluded to in the special mention of the treatment of this crop only guide one. Every farmer must cultivate his judgment, so as to make the application, applying the principle of adaption to every portion of the farm. One thing certain, all grass land should be kept fertile, for it is the rich fertile lands that better stand the drouths, or forward the crop before

the time of drouth. And again, I will strike the key-note—make grass the central idea of our farming, doing nothing to injure. Now with brain power put in use, and the farmer rightly heeding the signs of the times, being front in the march of improvement, having utilized his wet lands to the cultivation of grass, following the same system as with uplands except drainage, and there will now if never before seem to him that the Great Architect had laid up in those wet lands undeveloped resources to be brought out as a profligate humanity needs. Nothing so elevates the agricultural status of a country as the improvement of her grass-crop. It is the corner stone to all its prosperity. So as the soil improves, a corresponding improvement of the mind follows; the opposite is patent to the tourist through this state. The barren fields, dilapidated fences, neglected buildings and roads, but show him an illiterate, indolent, profane, Sabbath-breaking people.

SHALL MEADOWS BE FED?

This depends upon circumstances; it is not advisable to feed too close; neither advisable to have too much aftermath for the snow to fall upon. If the excessive growth was taken off with the mower long enough before winter that a good start would be made, and that made into hay, fed at the barn and the manure saved for application, it would be the better way; new seeded and moist lands should not be trodden upon by heavy cattle. But if meadows are kept highly enriched, it is not so easy to injure them by feeding.

THE NECESSITY OF A LARGER CROP.

While Vermont is plodding along producing less than one ton of hay to the acre, may it not be true that the labor of fencing, care and harvesting the crop, be greater than the crop is worth; while two tons produced, costing but little more to harvest, and sometimes less, furnish a good margin of profit? A great leak of Vermont farming is in mowing these unprofitable fields. More hay means more stock, more manure. Keep no land under cultivation longer than to produce a good seed-bed. To insure success in the cultivation of grass the farmer must utilize every opportunity to increase the value of his manure-heap, using absorbents about yards, stables, sink-spouts, privies, house-wastes, that all may be carried and properly applied to his fields.

EARLY CUTTING.

This has much to do in making the crop hold out. Who has not noticed a field early cut, before the seed is formed, how quick the second crop starts; there was vitality left ready to recuperate rather than an exhausted root, made so in perfecting its seed. So it is with the second crop; cut it as soon as the last of August or first of September. Don't again forget that "Grass is King." I would not discourage grain raising, especially corn, for it can be raised to a greater extent than we now raise it, and cheaper than it costs us to buy. It is a fine crop to raise previous to seeding; yet it takes so much less labor to raise grass and so much more of our land is better adapted to it, that in this is success.

MEANS OF IMPROVEMENT.

Now the state raises about 1,052,183 tons of hay, the valuation of which I will set down at $10,000,000. I believe profitably this amount can be doubled; and you are ready to ask how? When I see our lands becoming more and more dry, more and more emphatically do I proclaim, through my great enthusiasm, that the key to this whole subject is the raising of clover. I am an enthusiast upon this subject, believing any land, however poor, that can get a clover catch upon it, by judicious management, with water supply (yes, water supply upon any soil), can be made fertile with little, if any other, fertilizer than the plant itself. As requisite food is so largely furnished from the great storehouse of nature, being so leafy, they eat and drink ninety-five per cent. of their structure from the air; then it has the power of feeding in the lower soil from its great length of root, extracting hidden fertilization and moisture, bringing it up nearer the surface to be decomposed and disseminated to replenish its own existence and succeeding crops. By its excessive roots the soil is made light and porous to air and moisture, rendering it immeasurably improved by its mechanical effect. It has been ascertained that there are from twelve to fifteen hundred pounds of dried roots in one acre of good clover sod. These long roots have transferred the fertilizing matter from the lower to the upper soil. Then plow and turn under these roots and our lands will increase in fertility. Nothing prepares land for other crops like it. Then to turn under green, as a fertilizer upon lands difficult to manure (or if we have an excess of land for the amount of manure), it is of uncounted value. It is found that in a ton of green clover there are twelve pounds of nitrogen, two and one-half pounds of phosphoric acid and nine pounds potash, the very elements sought for and purchased by the Vermont farmer to an alarming extent, and it is feared, whether judiciously or not, at too great expense. I should limit this practice to the time when those extremely light, exhausted soils had been so reclaimed by this system as to produce a fair crop; then it would be better to hay it, feed and return the manure; but first it must be regained, and by the application of good "Nova Scotia" plaster, two hundred pounds to the acre occasionally, which is peculiarly adapted to the clover-plant. It can be established upon very poor soil. Potash or wood-ashes is a splendid adjunct; the two never should be lost sight of in raising clover on new seeded land. Sow plaster very early in the spring; then as soon as the crop is taken off sow again, to prepare the second crop. Use two hundred pounds to the acre in each case. And I urge every Vermont farmer, whether he be prejudiced against this plant or not, to enter this new departure. Grow clover wherever it will grow, not confined to one variety, for "Alsike" clover does splendidly on moist land and well mixed with red clover; for good clover makes good corn, good manure, and more of it, better cattle, better sheep, more milk and more butter.

SWINE.

In the raising of swine we cannot understand the value of a clover-pasture to turn them into, except by experience, until we go west and

see them in a field of clover, with no other subsistence through the summer, growing and thriving beautifully with air and exercise; no swine plague; that fine flavor to the meat, finished up with corn, that makes western pork so eatable.

WHEN TO CUT HAY, AND HOW TO CURE.

This is important. I have said, cut early for the good of the grass land. I have said, keep the land fertile, rich. It produces grass more rich in albuminoids, as the carbo-hydrates remain a good deal the same in every condition, and it is the highly albuminous food that is desired and most expensive to replenish. That immature young plants at an early stage of growth possess a larger per cent. of albuminoids and less crude fiber than more advanced growth is certain; and as the albuminoids, so is the digestibility of the same increased, as well as the extractive carbo-hydrates, and this digestibility varies in hay from forty to seventy per cent., according to quality of the fodder. I say cut early, as soon as early blossoming, and before, if inclined to lodge, and this will apply to all kinds and species of grass. I understand that some chemists and scientists, and practical men also, disagree with my judgment; but it will suffice to say that the tendency of chemical investigations is now more in favor of hay cut in early bloom, as against hay cut after bloom. They do not assign to hay cut out of bloom a value superior to that cut in bloom. The fact is there is a maximum and minimun point of value. When it is the most palatable and cattle will consume, digest and assimilate the most, then it is the most valuable.

The best chemist the farmer has is the cow, the sheep, the young growing stock. The working team, whose daily labor is constant and severe, may need hay from grass more mature; yet if the farmer would strike from his vocabulary the word hay and in its place substitute dried grass, and practically carry it out (as I believe for a few years), he will find as near blossoming time as possible is best. In expense of growing and utilizing grass he will be better paid to cut once, twice, yea, thrice, if the crop and time will permit, than to cut later. All grass, especially clover, is better to be cut when dry, after the dew is off, or before fallen, and by the use of the tedder can and ought to be dried evenly; not so much should be cut before it can be turned over to the sun, to prevent scorching, and when evenly wilted and hot put into small cocks; next day open partially; use care in not over drying so the leaves will fall off, put in the barn and mow up a section continuously until completed, and put upon the top six or eight inches of straw or old hay to absorb the moisture, and you will be surprised how green it can be put into the barn in safety, if void of water, and how much more palatable to the stock.

This principle applied in harvesting clover will apply to all grasses. But the clover question is a vital question, and I believe the salvation of our Vermont farms. Buy less commercial fertilizers; utilize the means nature has given by the use of this little plant in the restoration of the soil. I do not mean to discard other grasses, but surely cultivate them in connection, sowing timothy and red top with

clover to meet the liability of winter killing of clover. Never lose sight as the prime factor in grass growing or successful farming the cultivation of red clover wherever it will grow, for the land is in a better condition for succeeding crops than if it had not been upon it, though in a chemical point of view it is one of the most exhausting crops, while in a practical point of view it is the most restorative; it is the key that unlocks the fertility of the soil and renders it available for succeeding crops; it is a mystery, a strange anomaly. No doubt but a large amount of mineral manure is brought within reach of the corn crop by growing clover; for I feel sure of a good crop of corn, wheat, or potatoes upon a clover sod. It seems to gather up—so to speak—the phosphoric acid and potash disseminated in the soil, and when the great amount of root is decomposed, the mineral substances are left in an available condition for succeeding crops. Prof. Voeleker's "experiments showed an acre of clover of four tons, removed two hundred and twenty pounds of nitrogen; yet clover is not benefitted by nitrogenous fertilization; yet after the growth of clover the accumulation of nitrogen in the soil is extremely large." Behold it is a mystery, yet I believe (as in other words heretofore expressed) it is the sheet-anchor to Vermont farming. I have not spoken of pasture land, which probably is equal to two-thirds of our grass production. As this subject has been treated, under the head of the "Renovation of Pastures," so ably by an associate member of the "Board," calling out so full and elaborate discussion from the farmers all through the state at our meetings, and printed in our "Agricultural Report of 1881-2," that I refrain from touching this very important subject.

WASTES OF THE FARM.

By M. W. DAVIS of Westminster, Member of the Board.

The fertile soil of Vermont was formed during the drift period and was largely brought from the north, but with it may also be found the debris from her own rocks, still adding to its fertility. It is a soil which, if properly tilled, can be cropped for all time and still retain elements of plant food: and yet, from time to time, certain elements must be added. Not that there is waste in nature, but we, by carrying away our crops, change its fertility, and if we carry so much away we must return what is most essential. But nothing is annihilated. The atmosphere brings carbonic acid which is taken up by the plant and adds to its structure. Thus things are changed but not destroyed. The carbonic acid may be locked up in the maple tree. The coal pit changes it into coal; nothing has been lost or wasted. To-day we may enter the produce market, making purchases for our table to supply our bodily wants; to-morrow upon the ocean we may be cast overboard, becoming food for the fish; and again, the fish may be upon the table as luxurious food, bringing our very purchases to us only in different form; but here is no loss, no annihilation of matter; every thing is utilized. May not we, as farmers, in our business receive hints valuable to heed—guide-boards pointing the highways to success or failure. But while nature has fixed unerring laws in her government, man is often found uncertain. Nature's volume unfolds many a lesson for our study; her imagery of life's duties are ever before us.

Agriculture underlies the whole structure of civilization, the center of that "beautiful trio, agriculture, commerce and manufacture," says Daniel Webster, "the highest is agriculture." The ship of state is the whole country and the crew is but the laborers representing the numerous industries of that country. While thus considering our situation and running the race of life amidst sharp competition, great changes are needed in our agriculture. Our soil constituents have changed, our markets have changed, not only in demand, but accessibility; not only for the egress but ingress of the varied products. Habits of life changed with the development of our great country and ready communication.

Our war fostered extravagance and mortgages absorbed farms, and mamy were left without a dollar; some caught the idea of Horace Greeley and went west. Now it is best to know the worst, as Patrick Henry said, and then provide for it. Stephen A. Douglass said, "Vermont was a good state to be born in." If we may believe the sentiment of those who have left our Green Mountain state, we may conclude it to be a good state to live in. Hear the sentiment of the

Vermonters' re-union at Chicago when it was asked, "where shall we go to get the best horse?" Vermont. Where to get the best sheep? Vermont. To get the best cow? Vermont. The best wife? Vermont. And yet there is a disposition to get away from the farm, a discontent, and this infects the family; they hear daily from the father "that the farm don't pay," and the evening prayer of the mother, "Oh Lord, deliver us from this situation." But why this complaint? We see other vocations running side by side with agriculture, and yet agriculture should be ahead. May we not find in this enough to stimulate us? If by economy we can remedy the fault, then we need to think.

A few years ago it took months to cross the Atlantic by steam, but by the construction of improved machinery less than a week is all that is necessary. The invention of the telegraph overcame distance and utilized time, but the telephone improved it. The manufacturer studies to utilize every waste that amid sharp competition his business may give him a profit. Even sawdust and shavings, as well as smoke, are now utilized. (See the 7th Report.)

In the manufacture of aniline dyes and the bogus extracts, the residue even is used to kill our potato-beetles. There is also very much formerly waste material of the manufacturers made into paper, and the blood, horns and refuse of slaughtered cattle even, is all utilized, even for the benefit of the agriculturist.

With this long array of eye-teaching before us, let us stop and think, believing that no nation can be prosperous only with profitable agriculture. Such profitable production accelerates the rise in the social, moral and religious scale. One may travel through Vermont and when, perchance the highway, the fences, the buildings and all the surroundings are neat, tidy and tasteful, the inhabitants may not be seen, yet they may be known by their surroundings. If the buildings are dilapidated, fences down, brush and weeds in possession, a different class is indicated. Different habits are fixed, and when you bring the two classes in contact they are as diverse in what goes to make up high civilization as two distinct nationalities. As agriculture is neglected, so a people demoralize. We need self-examination. Man's life is so short nature compels him to achieve success by the art of utilization. This is often the key to unlock success with an advanced and improved nature. The progress of civilization has been to overcome waste; the genius of the age is to utilize that which has been hitherto lost. Now the receipts of our farm even under our complaints, may be, when we come to examine, more satisfactory than we at first anticipated; but the trouble is our expenses are such that the balance is on the wrong side. What the cause is, is my object to point out. If we give the farm its proper due, the rent of the the house, the garden, the wood, all it produces, less cost of producing and taxes, we shall find the farm pays more than loans. But the trouble is somewhere else, that we do not have anything left.

First. We must be adapted to our business, for I hold it self-evident if a man is not fitted to the business in which he is engaged he will not meet with success. Every person should early ascertain for what they are best calculated, and with proper information they will

make a success. This should be studied by the parent in the child's development, and by directed encouragement. If a man is adapted for the farm, has a love for agriculture, aspires to reach the highest round in the ladder, all other things being equally adapted, he is on the point of success. But he must inform himself, be perfectly familiar with his business. If we review the life of an Astor, Stewart or Vanderbilt, (they were not learned men) they knew all there was to be learned about their business. The Fairbanks, the man who blew up "Hell Gate," the Victoria bridge builder, so with the New York farmer who sent "Newton Pippins" to England, that sold in London market for five cents apiece, they all knew their business and met success. If a farmer is to be a dairyman, the farm must be adapted, the grasses fragrant and aromatic, the natural home for the better varieties, buildings all fitted for the business, water pure and abundant, family all fitted for it. Then the cow must be adapted in her mechanism, and the owner must know how to feed and care for her. She must produce three hundred pounds of butter called gilt edged. If he don't do it there is waste somewhere. One hundred and twenty-five pounds to a cow brings the owner in debt, and is played out. One is success, the other failure. If you, any of you, are keeping a butter dairy upon the wrong farm, fences disarranged, buildings inconvenient, water impure and scanty, cows not well wed out, a want of scientific knowledge in feeding, in handling milk, in its manipulation into butter, no faculty to market the same when produced, get right out of the business. If you are not a millionaire, you will be helped out of it if you do not.

Waste in the want of fertilizers manufactured. Many and many a farm is run on the declining scale for want of fertilizers, when all the elements perfect in themselves are at hand, which by small amount of labor could be utilized, and save an enormous waste; all the liquid manure about our stables should be supplied with absorbents sufficient to make a complete vehicle to carry it upon the soil; dried earth should be used and not let the most valuable and most desirable manurial product on the farm waste, and run away; when containing nitrogen the most costly to purchase. I urge emphatically to save and augment the manure heap; oh! the amount of this neglected source of wealth; an unbounded waste practiced to an alarming extent. Then there is the waste attending the burning up. Save manure, when by the application of the soap-suds from the house, or a supply of water, salt, sulphate of lime, or chloride of lime, to allay heat and arrest the evolving of the ammonia, all can be saved. And then don't forget the sink spout, after running it out under the very window of the sleeping room, odors of the most deleterious character inhaled by the family, producing sickness, doctor's bills, and death, waste of health, property and life, when if supplied with deodorizing absorbents you have the very best fertilizers, and save a large waste. The water closets, instead of being a nuisance as they often are, should be supplied with barrels of dried earth taken from the road-bed or elsewhere in mid-summer, placed accessibly to be used as occasion demands; thus many barrels in course of a year would accumulate of the very best fertilizer, and it would save much money now

wasted for commercial fertilizers. Third: the waste attending the application of manure, kind, manner and amount. Farmers are beginning to know, and ere long will be perfectly satisfied, of this enormous waste; application of fertilizers to the soil should be to feed the plants we are growing; the fact of application is, that something is wanting, *that something* the soil is deficient of. The causes may be numerous for the deficiency; that matters not. Now that something, is for the farmer to ascertain. It has been ascertained beyond a doubt no soil in Vermont adapted to grow the crop in harmony with its location, with a proper amouut of rain, dew, and heat to produce a maximum crop, needs but three constituents, and usually but one or two of the three, potash, phosphoric acid and nitrogen, yet the farmers have wasted by buying and applying compounds containing from nine to twelve constituents, not only paying for eight or ten parts they need not, but damaging their crops by over feeding, by excess, and it is a question whether or no the soil does not contain nitrogen sufficient; if so by excessive application of barnyard manure, the crops receive too much nitrogenous food and are injured; one of the greatest wastes in Vermont is over fertilization, putting on forty, fifty, sixty loads of manure to the acre, when acres of that farm, even the meadows, will not produce more than five hundred pounds of hay to the acre. Then not so much improving the weight of the corn, though largely increasing the stover, subsequently lodging the oats, injuring the grass catch, and some of the grass crops. When if but eight, ten or fifteen loads had been used once in two or three years, the land more frequently stirred, the mechanical condition kept better, you would find the aggregate crops would have been astonishingly larger. Nature has taught us the lesson; the forest annually throws off her mantle to recuperate her needs, so the grass dies annually to replenish fertilization in the resurrection of her kind; so the principle is less quantity of fertilization and more frequent. Homeopathic doses saving this untold waste in Vermont farming. Now the question will be how shall the farmer know what fertilizer to use, and the quantity. A few years since the farmer sought the chemist, and there he was told, send me a sample of your soil and I can in my labaratory tell you of what it is deficient, and what it needs to grow crops. This was all well, but the chemist could not tell whether those elements were in available condition as plant food; for instance, the soil might analyze as possessing silicates sufficient, and yet that silica might exist in sand perfectly abnormal as plant food; hence such attempts to benefit the farmer proved futile. Then the chemist goes to work and analyzes the plants of the farm, finds of what each is composed, and reasons thus: if I can bring together chemical elements like the elements of those varied plants, I have the key to the thing sought for. I am master of the situation, and the position was plausible; so Prof. Stockbridge says if you have a piece of land that will produce twenty-five bushels of corn to the acre, I will sell you a fertilizer to apply to that acre which will enable you to raise seventy-five bushels. Now the waste is here: while he furnishes all the needs for that plant's perfection, there may be in that soil all of the required constituents with the exception of one or two at most; so here the fal-

lacy of the system was, buying what we did not need, even that which was a damage because already even in excess, so the second system falls to the ground. The true way is to make the plant our chemist, as it is ever truthful. Then let every farmer feel that he is to be the student of his own soil; and he is to be the experimenter, and at once let him adopt the plot system as described in our previous report, and applying the different fertilizers, including his barnyard manure, putting the same value upon each plot. Put thereon the seed you think adapted, and in harvest weigh and measure, and that which gives you the surest answer, act upon, and all will go well. There is also

Waste in the improper rotation of the crops. Different crops take different constituents from the soil, and in order to keep an equilibrium of plant-food in the soil, we must work in harmony with nature, and while one crop feeds largely in one direction, the following should feed more in another direction, and thus recuperate, ever raising those crops suited to our market and climate that pay best, all things considered. Making the central idea, if possible, to raise those crops that take the least mineral matter from the soil; but feed from the air, the boundless store-house of nature, so as to save this wasteful expense for fertilizers, and a judicious study of the right application of crops to the soil is of the utmost importance. Now corn is a crop that takes the least mineral matter from the soil of almost any we grow, and most beautifully prepares the soil for re-seeding, and its cultivation under the new system should be encouraged, resulting in an increased fertility of Vermont farms as well as reducing our enormous expenditure for western grain.

Waste in the inoportune time of plowing land when too wet, or working it in any manner when not in the best condition to handle. Perfect preparation of the soil quickens vegetation, accelerates growth, shortens time of maturing the crop. Then there is a great waste in the improper time of harvesting crops; there is the right time, and no time will answer as well, and that time with all farm crops is short, and every crop must be studied to know when that time is. Cut your hay in full blossom for teams in work when seed is formed; cereals when passed into the dough, corn as soon as it begins to glaze; and as you deviate from this rule so waste will attend you.

Waste in the improper manner and time to market crops. First, neatly and honestly prepare crops or products for market, then as a rule sell when ready.

Waste in buying. There is a wonderful passion in some men to buy everything they see because at first thought it seems cheap; never considering whether they need it or not. As a caution against this vice place this motto in your kitchen: "Buy only what we need, never because it is cheap; beware of auctions."

Waste in misspent time at taverns, shops and stores. I wish the tavern-keeper or merchant would keep a memorandum of the hours some men spend thus, then present them a statement at the end of the year; it would surprise them, though the wife and family at home have some idea. The boards are off the barn, hinges to doors broken, farm tools out of repair, cattle in want of care, wood pile neglected.

But this is not all the damage; the boys taking pattern, social standing and position is obliterated; home becomes a waste, intellectual culture ignored, newspapers discarded, or not properly digested, books unread, while if those months wasted were devoted to home culture and repairs of its surroundings, it would, in a measure, save the necessity of gossiping neighbors ruining their characters, and make home and children happy.

Waste in the habit of smoking, chewing tobacco, drinking and similar vices. The first mentioned leading almost conclusively to the latter. Aged man, three score years and ten, who has used tobacco since he was fifteen (now you can recover almost fifteen years of such use,) tell these young men to-day how you used fifteen dollars (average) a year for chewing and ten dollars for smoking, making twenty-five dollars annually, and compute that annuity with simple interest and you have a problem for them to work out—cigar smoke. Compute your three cigars at twenty-five cents a day, and interest, and you have another. Oh, what a waste! But often, very often, it does not stop here; those habits lead to strong drink. Man of moderate drinking, compute your expenses and see that all this ends in poverty every time. This is not all the waste, no, perhaps, not the greatest waste; noble manhood is enslaved to habit, dwarfed intellectually, socially and morally, crippled and incapacitated for business, mind becomes dethroned, passion rules, crime becomes a pleasant associate, life a wreck, stranded in poison, possibly awaiting the doom of the gallows. Young man, take warning, I beseech you, in due season and pilot your ship by another chart.

Waste in the culinary department—our table service. I would not deprive any man or his family from enjoying the most at his own table, but that most enjoyment does not consist only in gratifying the palate or to appease a morbid propensity to gorge ourselves, but should, while the appetite is properly appeased, be so modified that the body and its functions receive the greatest amount of muscular force, mental clearness and exhileration, resulting in a perfect, healthy man and womanhood. Whereas the present habit of life is to load our tables with every viand, and thus produce disease, instead of desirable health, and doctor's bills and death come prematurely. There are families without number whose want of success lies at this very point. Why is it the Irishman, the German, the Norwegian, come here and take the farms that have gone, or must go, upon our mortgages, renovate and recuperate them, pay the mortgage and prosper? Largely for this reason of the cheapness of living, and yet live well, using the substantials of life, prepared in a substantial manner.

Waste in the selection and care of stock. Select that which is adapted to the business in which we are engaged, not only in breed, but age, yea form and constitution, for I believe that one-fourth of the stock kept in Vermont the past winter has been kept wholly at the expense of the owner. Yes, more; I verily believe if one in four had been annihilated right through our flocks and herds, and in their place those selected by the best judgment possible for the situation, Vermont would have been richer. My experience in wintering two year old steers, only deficient in breed, has suggested to me practi-

cally a great waste in one case, in the other the reverse. I bought one fall some steers from the north part of the state or Canada (years ago) and also some grade Durham steers from my own locality, square built, broad hip, while the others were fair in form and size. All were put into the barn and fed alike. The next July the grades made from one to two hundred pounds more dressed meat gain than the others. One gave a profit, the other a loss. So the same profit and loss runs through all of our farm stock. Cows can be so bred, wed out and fed that three hundred to three hundred and fifty pounds of butter annually can be made from the dairy, or without this care and attention, an average of one hundred to one hundred and fifty pounds is made; thus the difference constitutes the waste. Then there are scores of instances when the good herd of cows are so neglected, either for want of knowledge or other shiftlessness, their susceptible yearly income is reduced more than one-half. The same principle of waste that attends the cheese dairyman, attends the sheep husbandry, the pork industry, the poultry yard and all. Wasting, wasting, even one-fourth to one-half of the capabilities of our farms from these practiced delusions—that a steer is a steer, a cow is a cow, a sheep is a sheep, a pig is a pig, a fowl is a fowl, when by a sagacious discernment could all be remedied. Then the waste in feeding. I believe that one-fourth to one-third of the cattle forage and grain given to stock is wasted; first, in not securing properly for the barn, and, second. irregularity in feeding, misappropriation of food to the different kinds of stock, and above all to know how to combine foods to utilize their greatest nutritive value and have everything consumed in the most valuable manner. With all this, there is the waste of cold barns, requiring a fourth more of hay to keep the same stock, and yet it is suffered to be done year after year by many and many a farmer.

Waste in the securing of team and tools for the farm. I say Vermont made a great waste when she so largely changed the noble ox and steer from the farm for the unlucky horse. What looks better, finer, than to see the boys with their matched, well trained steers, steadied by the old oxen, upon the sled topping off with the little pair of calves on ahead, and as each year succeeded the other the older pair was turned into money, and the string kept good by another pair of calves; then the boys become disciplined in judging of cattle, size, color, disposition, and in their training were brought many rudiments preliminary to a future education. Whereas, the horse, noble and useful as he is, by being so common upon the farm in doing the work, and ever ready to be driven to town, coming in contact with lovers of trade, the spirit becomes contagious, and jockey is the name, and old run down, spavin, ring-bone horses with old harnesses is the rule of trade; time is spent unduly, habits of dissipation formed, and the two classes of people growing up under the two systems, methinks, could be contrasted. Understand me: I do not mean to discard the horse from the farm labor. I mean the change has been too universal; if the ox had been selected, matched, trained, fed, rubbed, bedded and cared for as the horse, he would be much nearer if not equal to the horse for farm labor.

Waste in not understanding the diseases of our farm animals. If there is anything needed in the agricultural department of Vermont it is a corps of veterinary surgeons. If young men would aspire to become thorough doctors, scientific, practical, for our animals, they would be hailed by mankind as humane to the brute creation. Many farmers lose stock enough to pay ahandsomeincome upon their farms —a good horse, or a good cow. or two annually, is a drawback pecuniarily, as well as a draft upon the nervous system, and very often this waste or loss might be remedied if we only understood the diagnosis of the case, and the care and treatment requisite. But beyond a certain line of knowledge made by practice, combined with a thorough theory from the best authors and schools, we need the most skilful experts to diminish this farm waste to its minimum. Then for want of this class the farmer should make it a study as much as possible by strict observation and reading to be thoroughly acquainted with the animals of his farm, or those he has to do with, enabling himself as far as possible the better to meet that unavoidable situation into which more or less he will be plunged.

Waste in the selection and care of farm tools. In going over the state I have thought I would like to collect all the farm tools that have stood out facing the weather this winter in Vermont. Wagons of all descriptions, carts, harrows, plows in the last fall's furrow, horse rakes, mowing machines, tedders, and have them brought together, what an area of ground it would require; when spring comes the plow is all rust, the handles or beam too decayed to use; the cart hub is rotten, the rake spoiled. Oh! what a waste; if cleaned and housed when not in use summer or winter, collected together in the fall and painted; iron varnished, whiffletrees, neck-yokes, eveners, manure forks, shovels cleaned and painted, and housed. Instead of buying two or three set during a life time, many of them but one of a kind is needed, without it is that a better kind is developed, and this brings me to the point of selection as science reveals and art produces; the better discretion which we should possess will ever enable us to lay aside the ancient for the new, and better model, keeping pace with the progress of the age, not wasting muscle, life, fortune, by tenaciously hugging to the old time-honored usage of farm implements, because so wedded to the use of them until very slow to believe any was or could be better.

Waste in the selection of farm labor. This involves a very large subject; the twenty years past has brought about great changes in the relation of labor to capital, the relative social position of the farmer and his hirelings; tbe time was when labor was not degrading, and those who were compelled to hire out to the farmer or others. expected to be faithful, true, constant, trusty; any were not eye-servants—dinner and sundown, or six o'clock, was little regarded; ever on duty from early morn until late at night, interested as the employer in all the particulars of the farm, eat when and what was set before him, all was right and happy. But now labor is most degrading, and the laborer is constitutionally tired. No interest except in dinner and pay; ears ever on the alert to catch the twelve and six o'clock whistle, but a little paralyzed at seven and one. Eye servants

can be endured only by those who can lead them in their daily task; they leave every tool where they cease to use it; to town every night, coming home sometime before morning, perhaps, to interrupt us in our sleep, enticing our boys away, or producing discontent by improper association before we are aware of it; our hearts are broken to know our James has been brought home intoxicated. Here is a waste that never can be repaired; waste of time, money, influence—of the nervous system; the breaking of heart and life; such too much has become the fate of families, farmers who seem necessitated to hire. If young men would regard their own character and standing, be diligent, faithful, honest, true, with an upright manhood, always in place and never out of place, should, and will be one of the *family* where he labors, have all the privileges of *home* instead of going to town as soon as six o'clock comes to participate in revelry and debauchery; he should frequently spend his time reading, or in intelligent conversation with the family; such a young man will cause this untold waste to be stopped, and he, whoever he may be, can command twenty-five dollars per month upon the farm yearly.

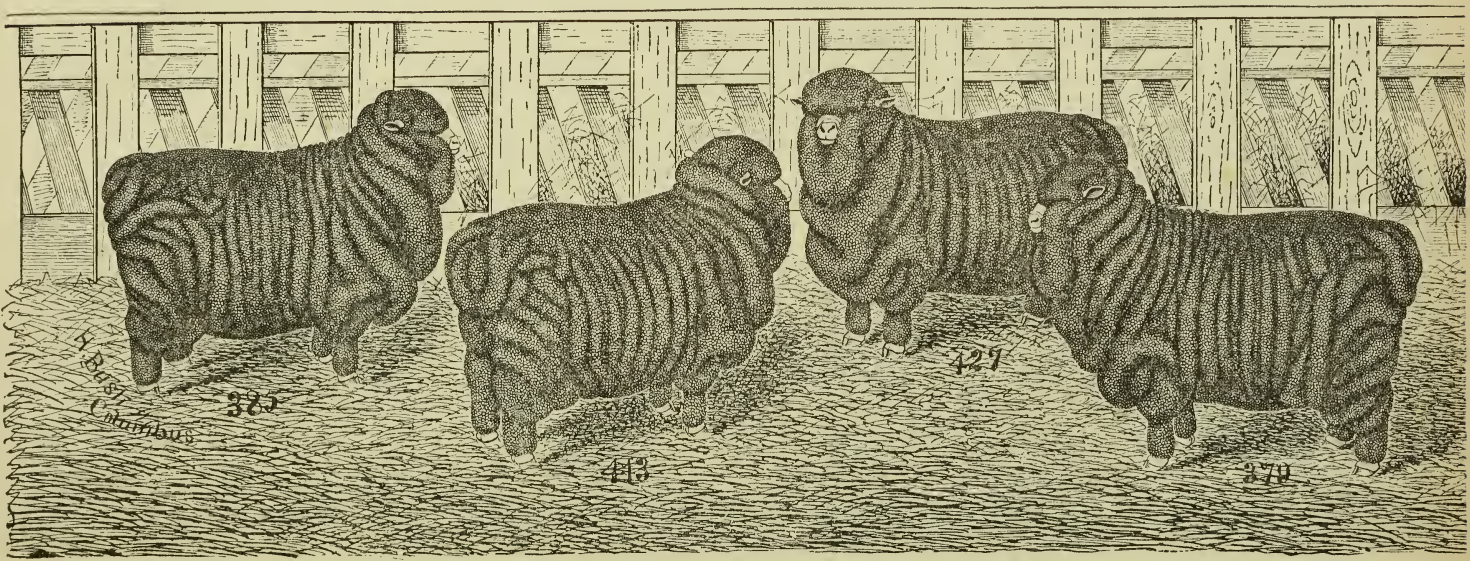
Waste in not keeping our work up in time. Here is a great drawback to the Vermont farmer, this waiting, putting off important duties until all at once they come pressing like an avalanche upon us. This should never be.

Waste in the injudicious management of farm labor. No system, no plan, no previous conception of what we are going to do until the time comes. No idea fixed in our minds of what we wish to do. The carpenter who is his own architect has every part and proportion of his building, from the sill to the apex; he sees it all; it goes with him night and day; his foremen know their work to night for the morrow or until finished. But how many farmers have made their plans years, months, weeks, or even days beforehand? How many hired men know at night when they retire what they are to do when they rise in the morning, but must ask from hour to hour what to do next, laboring along day after day undisciplined; all is confusion, with more or less fretting and chafing for want of system, or ability to execute.

Waste in not being better acquainted with our own families. "To know often is to love," to familiarize, is to make available rich opportunities for good. A great mistake is made in not making ourselves more interesting to our families—one of life's, yes, life's duty. Irremedial is the neglect; irreparable the loss. Most wisely should be our own daily training, as well as the selection of books, papers and associates, united with proper appliances to round up a complete, judicious, practical education for our children.

Waste in holding our lands at the old prices and expect it will pay. They must be sold or prized at their true value, which, after paying the labor for working, taxes and insurance, will give a fair margin of profit. Let new books be opened, a new balance-sheet kept, and farming pays, joy and gladness fills every household. Now if the Vermont farmer will overcome these wastes, avoid these mistakes or reduce them, taking in the situation as it is, farm-life will be changed. The door of opportunity is ajar; it is for each to push it

open, and there is no alternative. Like the young lawyer before the English bar, whose indolence reduced his family to poverty, yet whose intellectual and judicial ability to secure a livelihood, and even opulence, lacked only motive power, was sought with pleading earnestness, supplemented by wealth, to defend a young man from the death penalty before the highest tribunal of English jurisprudence. As he took in the situation, his own wife and children in destitution, his reputation waning, he resolved to make profound preparation; appeared before that eminent bench trembling; heard the learned arguments of the prosecution, rose under all these embarrassments while a vision flashed upon his mind and his innocent client, wife, children and all were thought of; then the confidence of these wealthy friends in his ability to defend this young man from ignominious death in preference to all this array of legal ability. I will push open the door, and before he was half way through, the bench, the bar, the jurors were perfectly entranced with his ability and eloquence, and when conclusion resulted in acquittal, amid the reverence of the brethren of the bench and bar and the embrace of the friends of the accused, presenting their rich gifts as feebly expressing their appreciation of his masterly effort. All due to that opportunity to "push open the door." Let us stop the wastes and a new era will dawn upon Vermont farming.



ATWOOD MERINO EWES.
Bred and owned by F. D. Barton, Vergennes, Vt.

BREEDING MERINO SHEEP.

By HENRY LANE of Cornwall, Member of the Board.

There are but few, if any, principles of breeding that all breeders will agree are established beyond a doubt. Many of these laws are as yet hidden from us. or imperfectly understood. The ideal standard for a Merino sheep differs among breeders, and the course pursued to obtain and perpetuate the desired type also differs. All the knowledge, experience, skill and success of our best breeders has left many questions yet unsolved. What we do not know is more than what we do know. If any breeeder, by long continued and close observation, or careful experiments, has succeeded to his satisfaction, and has knowledge beyond any of his predecessors, this light should not be concealed beneath a bushel. I believe that in the breeding of Merino sheep, and in their improvement, there has been developed as much, if not more, skill and intelligence, and as good care, as in the breeding of any kind of farm stock. In this statement I would not except the dairy cow or the trotting horse. Breeders may not have had the same definite type, form or merit in view, but whatever may have been their objective point, I think we can truly say all have striven with persistent and well directed efforts towards their ideal. Nature refuses to adopt our notions, views or rules as her law in breeding and confines herself to such limits as she chooses to make. There are many vexed questions relating to breeding that have not yet been settled. Different breeders have not agreed in their theories relating to breeding. The principles of breeding are too varied and change too much, according to the surrounding circumstances, and, as we study them from different points of view, it is not strange that we do not agree on many of these questions. There are but few facts, established beyond dispute, upon which are founded the art of improving a breed. Undoubtedly in breeding, as in other things, "like causes produce like results," but when we look for like results and are disappointed, the causes may be hidden and very unlike. Breeding is not an exact science, where we can base our practice on certain laws that are established, and with probable certainty predict future results, but the best results are obtained when we base our practice on certain theories, that are reasonably well founded. If the conditions were not so often unknown, the experience of a successful breeder would be definite and of inestimable value to succeeding breeders. Satisfactory results have occasionally been obtained, but the influences that caused them is a secret, and probably will remain so. Combinations that produce great results cannot be repeated with much probability of like results, and the problem will still remain unsolved; yet, I am unwilling to believe that breeding is all a matter of chance. Its operations, beyond doubt, are con-

ducted by fixed laws, the uncertain and varying results which so often disappoint the breeder are easily and sufficiently accounted for by the modifying influences of surroundings, care and conditions. These varying conditions, which cause in the descendant a dissimilarity to either parent, has always been a fertile subject for discussion among breeders. We have bred sheep of great beauty and wonderful wool producers. A lamb at one year old producing twenty-four pounds, and a mature sheep in one year producing from thirty-five to forty pounds, are great achievements, but in accomplishing these great results has there been any principle brought to light, or any plan of breeding developed by which we can profit, any reliable system formulated that has received general acceptance.

CARE.

Heredity is the ever-acting preservative force which tends to keep the offspring like their parents and ancestors, and hence make a breed possible. Heredity gives direction to the offspring, but only partly controls it, but there are other influences that modify it, that help to shape it, and many of these influences are in the hands of the breeder. The lamb may have better care and feed and grow larger, or be starved, and smaller than its parent. Art can supply condition that will influence growth, shape, quality and product. Good care, or the opposite, given to a few generations will give a new character to a flock and become part of its being, and then heredity tries and often does transmit this new character to the next generation. The law of nature is that the animal must transmit the tendencies it has itself inherited and acquired. Feeding has always been considered the requisite of success by all past celebrated breeders.

It may be laid down as an axiom that breeding alone can produce nothing beyond what is inherited in the animals coupled and their ancestors. It is food and management that makes a beautiful specimen of any strain of blood. Darwin mentions many instances where food has been the cause of variation in animals, while selection and breeding afterwards perpetuated that variation. All improvements require much time, and their value is in proportion to their fixed character, but their fixed character cannot stand long against an entire change of the food and surroundings which produced them. Many of our best Merinos, that go into unfavorable sections of our country, unfavorable as to climate and food, rapidly deteriorate, and the charge is sometimes made that deception was used in their sale, that they had been fixed up, that they were not as good as appearance indicated.

The soil and grasses of various sections unquestionably have different effects on the type and quality of the animal. The soil and climate of every district impress certain characteristics and qualities upon the sheep bred there. The favorable circumstances under which the Vermont breeder is placed has not only enabled him to establish and maintain a fine breed of sheep, but his efforts to improve have been crowned with success in the highest degree. Here a

uniform type and quality, if desired, can be maintained for an indefinite time, and improvements where made can, with proper care, be held. In most wool growing sections, especially the west and south west, the tendency is to grow coarser, thinner and lighter fleeces from generation to generation. The grasses and soil are of such a nature that it requires but a comparatively short time for our pure bred Merino to develop a coarsening tendency. There is another reason besides the grasses, the roving life which the sheep of that region lead, thereby developing a muscular frame, which strongly counteracts the effects of fine blood. In most of the western wool growing sections, sheep travel ten times the distance passed over by our sheep to obtain their food. If we desire to modify our Merinos, we can by care and feed furnish these advantages which aid them in overcoming obstacles and change their type. It takes a long effort of both breeding and feeding to establish the fixed characteristics of the Merino or other breeds.

CONSTITUTION.

The first point of excellence in an animal for breeding purposes that I will name is constitution. By constitution we mean all the characteristics which relate to health, vigor and vitality. I mention thisfirst because I consider it the most important. One may be a fine judge of desirable points in a Merino, may be a good care keeper, a fine breeder in every other respect, if he does not make constitution his first consideration, if he does not make this the foundation for his flock, sooner or later he will fail as a breeder. It makes no difference how strong the building or fine its architecture, without a solid foundation it has no permanency. A flock of sheep without this firm foundation, vigor of constitution, I don't care how well bred in other respects, it can have no permanency. The breeder, with this lacking, must sometime meet with failure. The weak and diseased should be wed out and vigor become a part of the physical system and thoroughly hereditary. While breeding for valuable points have this one vital point always in view, health, vigor and endurance. Without these you are liable to weakness, barrenness and a tendency to succumb to exposure and disease. When both sire and dam are vigorous and healthy, they are most certain to be prolific in healthy offspring, an increase that will be good feeders, taking their food with a relish, having sound health, vigor, fertility and longevity. All breeders, I believe, will accept and adopt as a good principle in breeding animals that we ought to have strong, vigorous, well developed parents on both sides. It is a question worthy of consideration how far the breeder can go in the production of oil and wrinkles and not sacrifice this all important point.

PEDIGREE.

Pedigree is the process of improving blooded stock by breeding. to points, and strengthening the heredity of the good points by "pedigree." Blood means careful breeding for a protracted term, for a special purpose; it means the development of some peculiar

excellence; it means the uniformity of type so essential when we know just what we want to produce; it means that any valuable characteristic that has been developed, can be reproduced. The greater number of ancestors possessing any special point of excellence, the greater the probability that these points will be continued in the offspring. Purity of blood is likely to give uniformity of type. Pedigree is good only for what there is of it; to be specially good it must have a line of specially good ancestors. The value in pedigree Merinos or thoroughbred Merinos, (sometimes so called,) consists in their ability to transmit to their offspring their own qualities. Their being bred in one line for many years their blood is so strong that they are able to perpetuate, with a good degree of certainty, whatever characteristic they possess. If their characteristics are of an objectionable nature, the producing them in their offspring will be just as certain as if they were of a desirable nature. Pedigree alone may have little value. A ram or ewe to be valuable for their increase must have individual merit as well as pedigree, tracing back to valuable ancestry. The presumptive evidence of the value of any line of pedigree is the merit of the animals to which it belongs. A pedigree Merino that has serious defects, and its ancestors had the same defects, the longer the pedigree runs back in a continuous line the more certain will these defects be transmitted to their offspring. Pedigree, therefore, may be valuable, and also, it may be without value. Here let me say a register of blooded stock to be valuable, should require for admission merit and pedigree. The Jersey cattle, that breed of animals that has been attracting so much attention and interest for a few years past, and selling at almost fabulous prices, have been bred on their native island for hundreds of years; they have a pedigree as long as the most fastidious could desire, but one-third of the increase from this pedigree stock fail on examination to show sufficient merit to gain admittance to the herd book. A defective animal is rejected by the examining committee as certain as a defective pedigree is rejected. It is a mistake to breed from a poor animal, because it has a fine pedigree. I would not give much for a pedigree as long as your arm, if the animal has no good qualities—is worthless. The value of a pure bred sheep, is, in its combining the greatest number of points of merit, and so backed by pedigree that in its breeding it will reproduce itself in form and character when it is crossed with another. It is a mistake to breed from a poor animal because it has a fine pedigree, a mistake that is not uncommon among breeders. The same pedigree will not always breed the same. This is noticed in twin rams or own brothers. A ram may be somewhat deficient in merit, and be a good stock-getter if in his pedigree it traces back through ancestors that were powerful to stamp in their offspring their own characteristics.

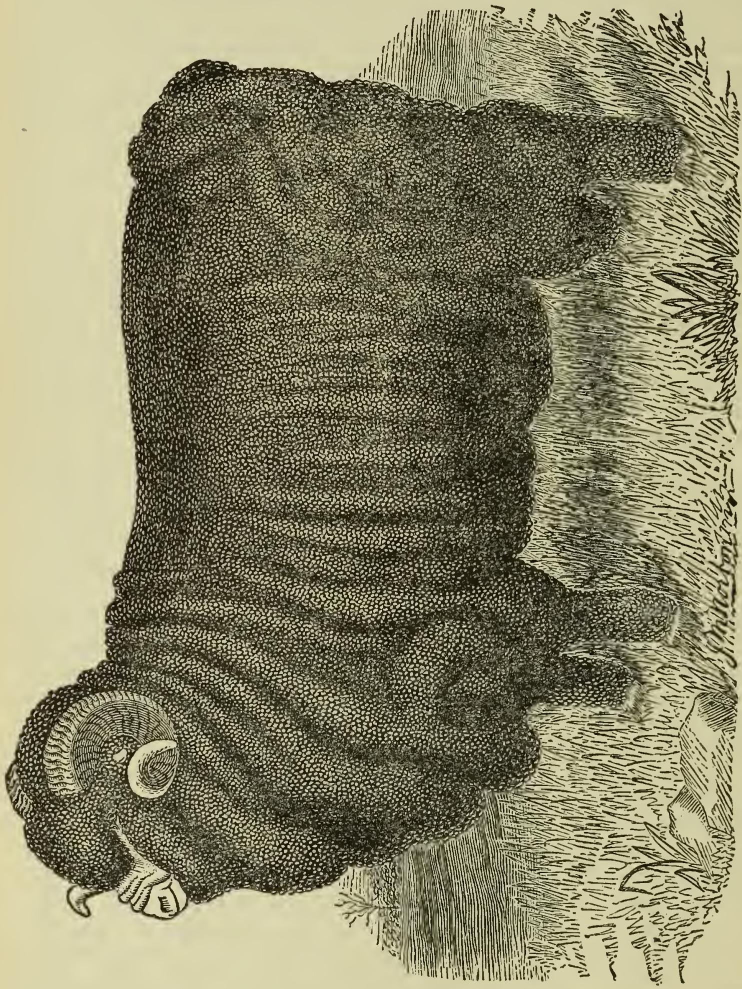
VARIATION.

You cannot have growth without change. You cannot have improvement without change, without variation; variation from the parent; variation from any of its ancestors. When the breeder is

satisfied with like producing like in his breeding, he is restraining his animals from being improved in their progeny. The law of variation should be the key-note for the breeder who desires to improve his stock. We may not fully understand the laws which govern or control variation. There is no doubt that management, care, food, climate, habit, all the surrounding conditions, modify and change the size, form, vigor, and fleece in all its qualities, and character so acquired, are, to some extent, transmitted in the offspring. All the causes we may not know, but the fact that these exist is what the breeder has to deal with, and he should hold every variation in the direction of improvement, and if possible render it permanent, and reject for breeding purposes every animal that the variation is in the wrong direction. Variation in all cases has a tendency more or less strong to be continued in the offspring, and if we can retain desirable variations for a number of generations, these will become established or permanent. This is the true theory that has enabled the breeder to improve by adding and holding from year to year the changes and excellencies acquired by care and condition. Progess comes through variation, not through likeness. It is this law of variation that has caused the great improvements in the past, whether the breeders are conscious of it or not, and it is this law that we must apply in order to produce progressive results in the future.

If a breeder has obtained all he desires in his flock, has nothing more by way of improvement to accomplish, then the law of likeness is of the most importance to him, as he will desire to so modify conditions as to restrain his animals from being improved, but to the breeder who is not satisfied with present attainments, but desires to further improve his flock, the law of variation is deserving of his careful attention. Heredity is not the only influence or force at work in the production, growth, type, and quality of the animal. Heredity gives direction to its growth, but it only partly controls it ; all through life those elements that nourish it, also modify it, and this may be a sufficient reason why the offspring is never quite like its parent. The lamb may have better feed and care, and grow larger, or be starved and neglected and be smaller, or other influences help to shape, to modify it, to give it a different type from its parent, but whatever new character it takes on, becomes part of its being, and then heredity tries to transmit the new character to the next generation. I presume every breeder can recall instances where Merino sheep have changed ownership, and passed into hands where poorly fed and poorly cared for, and in a few generations the character of the flock was entirely changed, a variation in the wrong direction was produced. You can also recall instances, right the reverse of this, where variation in the right direction was produced. Art can supply condition to influence growth and modify a breed. Animals growing wild seldom have these influences to produce variation. Take any of our wild animals as an example. The red fox of to-day is the same as that of fifty years ago ; the same in size, color, fur, and type ; no change, no variation. The law of this reproduction seems to be as fixed as that which gives to the casting the shape of the mold, be it repeated times innumerable. I will here refer to a

few instances of marked variation in our Merino, and I will select some of the most marked instances without prejudice, (we should consider this point without prejudice). Take the McCaulley lamb of last year; in this lamb there was a great variation in points of fancy



"ALL RIGHT."

Bred and owned by R. J. Jones, of West Cornwall, Vt. "ALL RIGHT" was the head ram of the flock that won the gold medal, as best Merino flock, at the Vermont State Fair in 1876.

or points of merit that reached nearer perfection than any lamb ever dropped within my knowledge. I give this as my opinion, and I believe it is the opinion of nine out of every ten unprejudiced breeders. Now in this lamb some cause produced a variation in point of merit far beyond those of his sire or his sire's ancestors. Take King All-right as another instance, in this ram was a variation of ten pounds more weight of fleece, and at least twenty-five pounds more live weight, than its sire or his ancestors, a marked variation or improve-

ment in two desirable points of merit that breeders are seeking after. Banker and Rip Van Winkle are other instances where variation and improvement were far in advance of any ram in the line of their breeding that preceded them. In these striking instances of variation it is not to be expected that heredity will transmit their own qualities with that certainty that it would had there been no variation, and they had been like their sires; but we can reasonably expect some, at least, of the offspring will vary in that direction, and in the second generation more of them, and so in time that variation which was so marked in the direction of improvement, becomes established, fixed, and permanent. We often hear this remark (and it is a remark founded on fact) as to the increase from rams, that by variation, are far in advance of any that preceded them, that their stock was not uniform; that while they got some extra good lambs they also got some ordinary ones. This will most always be the case with a ram that stands pre-eminently far in advance in point of merit of any of his ancestors. If you wish to breed uniformity, take those that have been bred in that way for generations, those that are not better than their ancestors twenty or thirty years ago. Variations have a tendency more or less strong to be continued in the offspring, and if we can retain desirable variations for a sufficient number of years, these will become fixed. To give an advance this year and gain another next, and so on continuously, is the secret of successful breeding. What the possibilities are of thus accumulating a special character or the limits within which it must be kept no one knows. It looks now as possible to us that a fifty pound fleece may be reached as it did ten years ago that forty pounds could be obtained.

SELECTIONS.

Judicious selection is indispensable to success in breeding, and this should have regard to every point of merit, form, fleece, pedigree and constitution. The art of accurately judging sheep, of selecting the best for a given purpose, is of incredible value to the breeder. In every flock are a few animals superior to all the rest in every particular that is desirable. Their superior qualities are transmissible to its progeny. By breeding from these selected animals this superiority accumulates and an improved type is the result. You may carry desirable qualities, by selection, too far, to a point beyond which any further change in that direction is no longer an improvement. Take as an example wrinkles: a certain kind, quality and amount of wrinkles are, by most breeders, considered desirable. By selection improvement in this direction can be made, but this may be carried to excess, and "too much of a good thing" becomes a defect. The same with oil. This may be true in respect to other points, such as fineness of fleece, length of staple, oil in fleece, size and form of animal. A few breeders seem to have some one hobby that they ride to death. It may be any one of the points just mentioned. If it's oil, it may be carried so far that there's more oil than wool. If it's length of staple, it may be carried so far as to lose

other equally desirable qualities. If it's fineness of fibre, it may be to sacrifice almost every other valuable point. When we have reached a point, which to go beyond would not be an improvement, we must use selection to maintain the excellency already attained. The improvements that have been made have come through the selection of sheep of merit, of particular excellence, and the best in the flock to breed from, and weeding out the poorest. A good animal is the first consideration in selecting breeding stock, good ancestry is second, and this is determined by pedigree. Pedigree is good for what it represents ; its value depends upon what kind of animals there is in the line of its ancestors. It can never take the place of selection. The practice of selection, the continuous weeding out the poor, is the plain common-sense view of breeding. If there is one principle of breeding which is more fully acknowledged and practiced than another it is Darwin's theory, that of the "survival of the fittest."

Some breeders allow themselves to be too much influenced by pedigree or some striking merit. Selecting animals with fewest defects is probably a better and safer rule to go by than to select the animals with the most good points. A few showy and desirable points should not so attract one that several serious defects might be passed over. There is many times, with sheep of the same pedigree, such a striking contrast in points of merit that but few breeders would hesitate for a moment which to select. I will give one illustration: the twin three year old rams, exhibited and shorn by B. B. Tottingham & Son, Shoreham, at the public sheep shearing at Middlebury last spring. These twins were, in general appearance, as near alike as twins generally are. The fibre of wool on one was four and one-half inchs in length, on the other three and three-fourth inches, a difference of three-fourths of an inch. The longest staple ram weighed, after shearing, one hundred and fourteen pounds, the shortest staple ram one hundred and thirty-five pounds, a difference of twenty-one pounds. The longest staple sheared twenty-three pounds twelve ounces, the shortest staple thirty-three pouuds ten ounces, a difference of ten pounds lacking two ounces. This extra ten pounds came mostly from a much denser fleece. Now, you might possibly find one breeder in twenty, whose hobby was long staple, that would select the longest fleeced ram, but the other nineteen would select the one having so many good points, to be found in the shortest staple ram and that were lacking in the other.

FANCY.

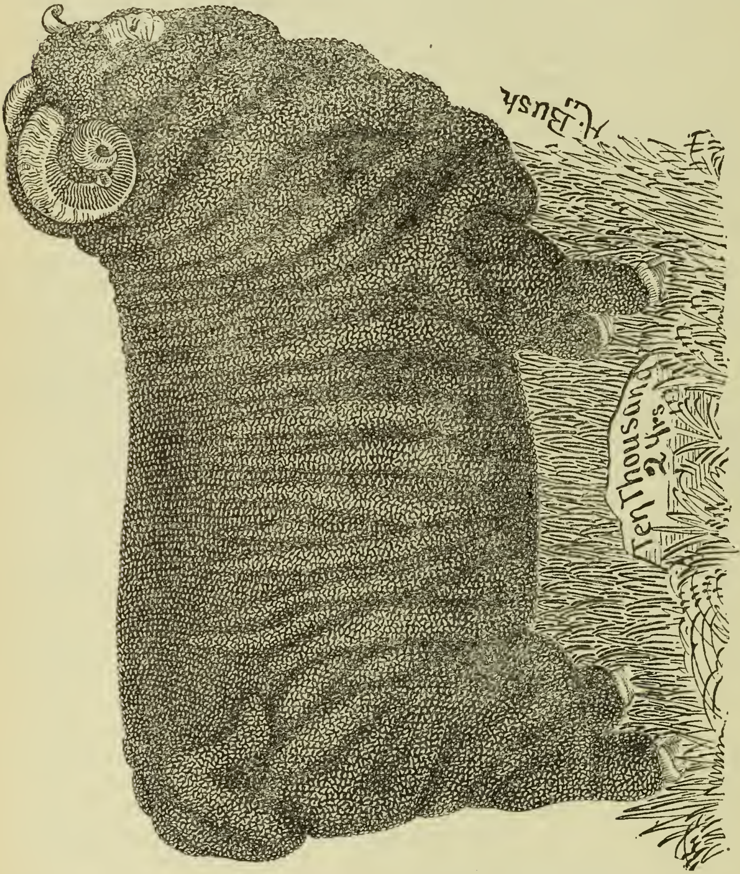
There is much attention given to this question of fancy among breeders of blooded stock at the present time, and this question enters into the breeding of Merino sheep, and with a degree of importance that cannot be ignored. There is no end to the difference of opinion upon this fancy question; hardly two think alike as to the rank fancy should hold to merit, and we find some who would entirely disregard this fancy question in breeding. A Merino is a great wool producer, and to a lover of sheep is an animal of beauty. If beauty is not incompatible with merit, and is not an obstacle to

her development as a wool-producer, I can see no reason why we should ignore its claims as a thing of beauty. The breeder's aim has been, is, and should be, to develop her wool capacity in quality and quantity to the highest limit; yet, we cannot afford to disregard any legitimate collateral quality that will tend to enhance the money value of the stock we raise to sell.

I noticed in one of Kellogg's combination sales of Jerseys, last October, that the prices varied from $15, the lowest, to $3000, the highest. When we consider merit alone we can hardly conceive it possible for this difference in value. For milk or butter there is a wide difference in value in every herd of cows. One may pay a good per cent. above care and keep, and another run its owner in debt every day she is kept. Of course, in these extremes there is a wide difference in value, but on merit alone we can hardly see the difference of fifteen and three thouand dollars. In the latter price we see besides merit the solid color and black tips. To a Jersey breeder, whose fancy is solid color, a white spot the size of your hand on a cow of great merit as a butter producer, might lessen its value from one thousand to one hundred dollars. Breeders of Merinos know how this is: two sheep of equal merit as wool producers, one with a black spot the size of a pea on its lip, face or ear with many purchasers would make the unequal price between the two, of one hundred to ten dollars. It's folly to "kick against the pricks." It's not wise to ignore facts in relation to breeders' fancy. Wrinkles have merit. The great weight of fleece could not have been obtained without them. Wool sells, wrinkles sell, and often wrinkles bring the better price, but the number, size, kind, where placed, and at just such an angle, are questions of fancy, and the breeder who expects good prices cannot afford to disregard. The soft, silky face, without spot or blemish, covered with wool to just such a point, and then stop short, too much a defect, as well as too little, with one or several wrinkles across a short nose, are fancy points. These wrinkles across a Merino nose may have no more merit than the black tip of the Jersey's tail, still the breeder cannot disregard them, because there is money in them. The surface color of the Merino is a fancy point of but little merit, but so important is it considered that if breeding and housing will not give it I am credibly informed that it may be artificial. So important is the black tip of the Jersey that it may be artificial too. What we call fancy points must be carefully considered in selecting pure bred sheep. It is a fact, that I presume you have all noticed, that when a committee, visitor or purchaser enters the yard or shed, at the first glance, as if by instinct, they are looking for the fancy points, or to detect the absence of them. You may bring up to your visitor for examination a sheep that in form or fleece has the most merit of any in the flock, if it should have a small black spot on its lip, it most likely would be examined with indifference. While we should not disregard fancy points, there is danger of this being carried too far, that these fancy and desirable characteristics may so attract one that several serious defects may be overlooked or passed over. Fancy should not be secured at the expense of the more useful character, that is, merit should not suffer at the cost of fancy points.

RAMS.

The quality of prepotency is one of the most important considerations in selecting a stock ram. That power to perpetuate the sire's merit in their offspring is superior to all other considerations. A ram to have this necessary prepotency must have three qualifications,



ATWOOD RAM.

Bred and owned by R. J. Jones, West Cornwall. Vt.

form, constitution and pedigree. Greater improvements in the Merino flocks have come from the qualities conspicuous in the ram, instead of those conspicuous in the female parent. The reason is evident when we consider the greater care in selecting the ram. Breeders owning fifty or one hundred ewes are not satisfied with selecting a ram of uncertain qualities, but many times, regardless of price, select one of known good points, and one that will most likely transmit them to his offspring, while in the flock of ewes there may be the good, bad and indifferent. Breeders should pay the greatest attention in selecting the stock ram on account of his more extended services and the more numerous produce of which he would become

the parent. A large proportion of the stock rams that have been and are being used in the country came directly from a few of the best flocks; either were raised by these few breeders or sired by rams bred by them. This is wise on the part of a large majority of breeders. A few breeders have by perseverance and intelligent selecting and breeding from rams and ewes which possessed the important and fancied requisites of a good Merino, in character superior to those of the more numerous flock, and these desirable qualities being thoroughly inbred and firmly fixed, that the increase will possess all the desired points in the greatest perfection and best condition.

PREPOTENCY.

In selecting sires the greatest care should be observed as to individual merit, as well as pedigree. Rams should be the best individually and the best bred, and by virtue of pedigree their influence on the offspring should be overpowering. Prepotency in an ancestor or strain of blood is the most important consideration. Individual merit may not give prepotency; the best pedigree may not give prepotency. We may admire individual merit, but of what value is it in an animal for breeding purposes if its merit dies with it and leaves no impress on its offspring. When you can combine prepotency with merit and pedigree, you have a stock sheep that is a prize to any breeder. There are many facts to confirm the idea of the superior influence of the more potent animal in perpetuating individual merit. As an example, take Hammond's Sweepstakes, that had a line of prepotent ancestors back through Little Wrinkley, Old Wrinkley, Old Greasey, Wooster, and Old Black, and from Sweepstakes, down through California, Gold Drop and Green Mountain. In these was a line of merit and pedigree and prepotency to stamp their qualities on a large number of stock sheep in Addison County that made in their day great improvements and stamped their impress on almost every flock in the county and state. Another line of prepotent rams is the Allright line, bred by R. J. Jones. This line is from Standard back to Allright, by Nevada, by Chub, by Seville, by Comit, bred by W. R. Sanford. From this line of stock rams has sprung a large number of valuable stock sheep. Eureka is another ram that has produced a valuable line of prepotent rams.

IN-AND-IN-BREEDING.

Perhaps no question in relation to breeding has had warmer friends or more bitter opponents, and has been more freely discussed, than that of in-and-in-breeding. The advocates for and against are earnest and confident of being right. Close in-breeding, if long continued, has a tendency to induce weak constitution and sterility. Breeding from animals of various degrees of relationship, and sometimes from the closest relationship, is often practiced by the best breeders, and in many cases is necessary in order to fix or continue extraordinary excellence. At the present day there is hardly the necessity for Merino breeders to pursue close breeding that there was at an earlier

period in the history of this breed. Thirty or forty years ago they were compelled, by the comparative fewness of well bred Merinos, to a repeated use of the same ram on offspring of his own begetting. With the advantage of a large number of flocks and different strains and families to select from there is no necessity at present for close breeding. A successful breeder of years ago once said "in breeding was sure to produce an uncommonly good or an uncommonly poor animal." It is noticed that those who deny any necessarily evil results from the practice will say that we must not continue to breed "too close" too long. If the ancestors in line a few generations back were sound, healthy and vigorous animals, we may not be able to give any reason why the offspring should not be equally sound, healthy and vigorous, but without giving any reasons for it, the facts are that evil comes after a continuance of the practice. So close an observer as Darwin admits that in breeding tends to perpetuate the merits of the parents at the sacrifice of constitutional vigor. The strongest advocates of in-breeding admit this danger and say caution and good judgment must be exercised in practicing it, and in view of this danger recommend the establishment of two or more lines or families of in-bred animals, each of different strains of blood, but of decided merit, and as weakness or barrenness appear, take out crosses from the one to the other. Some of the most remarkable stock getters of the various breeds have been produced by close breeding. By such breeding, if an animal of genuine merit is produced, and one of the most important points of merit consists in prepotency, they impress every animal with which their blood comes in contact.

CONTROLLING CHARACTERISTICS.

There are various theories in relation to the part or power the sire and dam exert in transmitting qualities, that the one gives the leading characteristics of the form and external structure, from the other the vital organs, constitution, habits and temper. There has been some noted breeders who have had faith in this theory. No less a breeder than J. N. Blakeslee says, "Experience has taught me that in breeding animals the offspring partake strongest, in their outward coat and appearance of the male, and their temper and disposition of the female." This theory, I think will not bear the test of experience, and can be of little aid to any one. The more vigorous and potent parent will, unquestionably, give controlling character to all the qualities in the offspring.

LAW OF SEX.

Some breeders of extensive and close observation have advanced theories which they claim will, to a limited extent, regulate or control the sex of progeny. I do not propose to discuss this question. There has been no theory presented but that some facts could be found to substantiate, and also quite as many facts to refute the same. Breeders, from some cause, may one year have a large preponderence of one sex, and next year, by supplying the same conditions, so far as the conditious are known, have opposite results.

Nature seems to have provided that the number of either sex produced shall be nearly equal, and man has not as yet found a law that will in the least disturb the equilibrium wisely established.

CONTINUOUS BREEDING.

At a sheep breeders' meeting in Middlebury last winter this theory was advanced, and some facts presented to substantiate it: that the two first, or at most, three crops of lambs were better than any succeeding ones if there was a continuous use of the same ram on the same ewes. I do not believe any thing in this theory of breeding. I can't understand the cause for any such results, and the weight of facts are against it. What were presented as facts I think must have been too hastily drawn conclusions. If you undertake to judge of the merits or quality of the young of any kind of animals, you are very liable to misjudge; you cannot tell at weaning time, or at the end of the first year's growth, or in fact, any time until the animal has reached maturity, what quality of an animal it will develop into. There are different influences to affect the development of the young, growing animal—influences to affect it favorably or unfavorably at different periods of its development. If you undertake to judge the animal at any of these periods, you are liable to draw conclusions that may not prove to be facts. How often the colt, calf or lamb develop into a much poorer or better animal than what we expected they would from what we could see while passing through the various stages of their growth. How often breeders have too hastily judged the value of a stock animal, and misguided by the character and quality of the stock when young, sold such animal, only to purchase it back regardless of price or distance, because the stock when fully developed proved to have great value. If you undertake to judge progeny previous to maturity, you are liable to draw incorrect conclusious. It is very common to have a flock of ewes do better by their lambs some seasons than others. The condition of the ewes, the season, or the pasturage, will cause this variation. Because the third or fourth crop of lambs from the same combination do not look as well at weaning time, or at the end of the first year's growth, it should not be presented as a fact to substantiate a theory. Wishing to ascertain the opinion of some of the best breeders in our country of cattle, horses and sheep, I addressed a letter like this to a few breeders: "What is your opinion of this theory in relation to breeding, that a continuous use of the same male on the same female, the offspring will not be as good after the first two or at most three combinations, and can you in your experience in breeding mention any facts to substantiate or refute this theory?" In the replies not a single breeder has expressed an opinion in favor of this theory. I will give extracts from some of these letters bearing on this question.

VIEWS OF BREEDERS.

William Crovier of Northport, Long Island, writes: "My experience with rams is as follows: I purchased the Cotswold ram King

Tom, in England, and bred him five years. The last year my lambs were fully as good, if not better, than they were the first year, and should continued to have used him, had he not got injured and died." Mentions another instance where he used a ram four years on the same ewes with like results. A. I. Alexander, Woodburn Farm, Kentucky, says: "I cannot think that breeding the same ram to the same ewes for three years would deteriorate the flock."

T. L Miller, Beecher, Ill. "The question raised to wit: the continuous use of the same ram on the same flock of ewes that the increase would not be as good after the first two crops of lambs, or at most after the third crop. I know this view is held by some flock-masters, but I should doubt its correctness. From my own experience I have no occasion to think it true. Standard I continued to use while he lived, and his death, I think, was a great loss to me. I have been using my old bull, Success, ten years. Although he is eleven years old I would not part with him for $10,000. I am a strong advocate in the breeding of cattle: that whenever a bull has shown himself a good getter, to keep him while he will work, and I believe the plan to be a good one."

M. H. Cochrane, Compton, Canada, writes: "I would say, in my opinion, the use of a male animal to the same females year after year would not be likely to result in a deterioration of produce until the sire should have lost vigor by reason of old age."

Watts & Seth, Baltimore, Md. "Your asking the effect on offspring by using the same sire on same females for many years, and is it deleterious, is received. We do not believe it to be true with cattle, but just the contrary."

"I. Milton Mackey, Great Barrington, Mass., says: For twenty years I have been a breeder of registered Jersey cattle, and my experience on the subject you inquire about, is, that while in a few instances the last calves sired by a bull were inferior to the first, in a large majority of cases; the second, third, and fourth calves of the same sire were the best. If any such law as you speak of exists in sheep, I am disposed to think it must depend on the fact that rams are over-worked."

Smith & Powell, Syracuse, N. Y.: "If we understand you right, we see no reason why an animal bred into the same herd and to the same animals year after year would deteriorate. We certainly think this is not the case in cattle. It you look at the human race, would it be reasonable to say that the fourth, fifth, and sixth child, and so on, is less capable and healthy than the first, second and third. We cannot call to mind a single instance either in the human family or in animals where the fourth, fifth, or sixth offspring was not quite equal to the first."

Miller & Sibley, Franklin, Pa. "In relation to your query, will answer: We do not believe that the continuous use of the same sire in a herd can injure in any way the offspring. If such be the case we should change our social customs and marriage laws. Between breeding in the brute and the human, we take it there is no marked difference."

Powell Brothers, Springboro, Pa.: "In reply would say, that there is no reason why, especially if the sire is better than the dam, that the continued use of the same ram on the same ewes would not increase rather than diminish the value of their progeny, if the sire is not bred to his own get. This is an acknowledged fact by all breeders."

AGE TO BREED.

The last question that I will present is this, at what age should Merino sheep be put to breeding. In discussing this, like almost all questions pertaining to breeding, I am aware that I enter upon disputed grounds. Practice is not the same with all breeders. Some breeders believe it's better to commence breeding their ewes at two years old. Other breeders believe that three years of age is the best time to commence. Now what effect does either practice have on the individual so bred, on the offspring and on the breeding or improvement of the flock in the distant future. There is a provision, or law of nature, that all animals, all kinds and breeds can reproduce before maturity. Some kinds can reproduce when they have reached but one fourth their period of growth. The guinea pig will continue to grow for one year, but will have young when three months old.

Other kinds will reproduce when one-third or one half the period of growth is reached. With the heifer, of some breeds of cattle, it is at one-third of its growth. With the Merino it is about one-half the period of its growth. The Merino ewe, as grown by most breeders, if not put to breeding will nearly or quite reach their growth when three years old. Not always will this be the case. The reason given by some breeders why they are not put to breeding earlier is that they may nearly reach maturity before any strain is put on their system by breeding, and then all breeders of blooded stock desire to have a few show animals, and those that have reached maturity before breeding are best for this purpose, show to the best advantage what has been accomplished in the flock or herd. Now what effect does reproduction before maturity have on physical development? I think it may retard it, but does not weaken it. It would look a little strange that if the animal, in accordance with the law of nature providing for reproduction before maturity, was put to breeding and thereby physical development weakened, that by complying with a law of nature degeneracy would follow. This I do not believe in. Wild animals that are not under the control or restraint of the hand of man reproduce soon after this law permits them to. I am not aware but that they have the same physical development that they had hundreds of years ago. Intelligent and long continued observation with the human race show that married women who reproduce on the average reach a stronger, healthier and better physical development than unmarried, or married women that do not reproduce, and this is an argument in favor of early marriage, or marriage and reproduction before growth is completed, that they have a better development and longer life than if reproduction commences later in life or does not occur at all. What are some of the reasons in favor

of breeding our ewes at two years of age. First, a crop of lambs one year earlier, which gives a more rapid increase of the flock. Sec ond, a more certain aud continuous breeder. If animals are restrained from breeding until part of their period of reproduction is passed, the result is much more likely to be barrenness. This is coming to be a very serious defect in Merino flocks and any course that will in the least increase this defect should be avoided. There is a tendency in all high bred animals to barrenness, and the longer bred, the closer and purer, the more this becomes a serious defect, and any course that will tend to prevent this should be pursued. I think there is no question upon this point, that an ewe put to breeding at two years of age will make a more certain continuous breeder, You have only to look at the early and late marriages in the human family to prove this position to be correct. The third reason that I will give in favor of early breeding is a better physical development. Experience does not prove that full development must proceed reproduction, or if it does not development will be dwarfed. It is not true, as some may believe, that in order to reproduce the animal must make a strain upon itself, that it has no power left to carry on its own growth. Growth is greater during the five months the lamb is carried by the young ewe. During the three or four months of suckling, the ewe loses flesh, but this is restored very quickly after the lamb is weaned, and by the close of the year will be quite as large, and generally larger, than the barren ewe of the same age. The best developed animals of any flock or breed will be those that reproduce before their full growth is reached. If the animal is properly cared for, reproduction aids physical development. There are almost always a few in every flock of two year old ewes, from some cause, much undersize; these I would not put to breeding until another year's growth was completed. The fourth reason I will give in favor of breeding two year old ewes is this. they will have longer life. There is this law of nature that has little variation, that with all animals and all breeds, the longer in reaching maturity the longer life. The Merino breed are slower in reaching full growth than the mutton breeds of sheep, and they are also a longer life breed. Early maturity is desirable in all meat producing breeds, but not so desirable in animals for the production of wool, milk or labor. If by forced growth, if by feed to produce early maturity, if by withholding breeding until maturity is reached, the tendency is to change the Merino in this characteristic so that full growth is reached as soon as it is in mutton breeds, and you very much lessen the value of the breed. A ewe that reproduces at two years of age and again at three years of age will most likely be one year longer in completing its growth than the ewe that does not reproduce until it is three, but it will in the end have a finer physical development, a longer life and a more profitable life to its owner. There is this objection raised against early breeding, that the fleece is effected unfavorably. The fleece does not appear as firm, is not as dark color, appears lighter, is lighter in weight. This will be the case, more or less, with every ewe that breeds at whatever age all through life. This effect cannot have any permanency, cannot be in the least unfavorable to the breed

as wool producers, in quality or quantity. Growth of wool is determined by breed and individual peculiarity and only secondarily and within known limits by the effects of reproduction. The effect on the fleece by breeding the ewe young is only temporary. The lessening of weight of fleece is more in oil than wool and this lasts only while the ewe is suckling her offspring.

The Merino of to-day differs widely in their characteristics from the Merinos that were imported or even from those of twenty five or thirty years ago. They are very artificial production. They have reached their present degree of excellence under vigilant care, skill in breeding, selection and perseverance. If improved in this way, they can only be maintained by the same kind of selection and care which produced them. If care and selection is withdrawn, they will deteriorate as rapidly as they have been improved. It requires as much skill and care to maintain a good breed as it does to produce one.

ROTATION OF CROPS.

By Henry Lane of Cornwall, Member of Board.

I shall not attempt to lay down any specific order of succession in a rotation of farm crops. There are various objects to be attained by means of rotation. The different circumstances in which farmers are placed renders it necessary to deviate from any fixed direction or system. I will say this in the outset, that, while a wise rotation will assist the farmer in retaining or restoring fertility to his lands. I know of no way, no system, that can be pursued that will retain the fertility of our farms, unless their annual crops are returned to them to preserve their capacity of production. The wealth and prosperity of the state is measured by its annual crops. The great object in the farmer's labor in tilling the soil is to produce plants and animals. Animals, plants, and soils are composed of the same organic and inorganic substances; but while the earth is such a great storehouse of plant-food, a small proportion only is in condition to be transformed into plants and animals. That system that will release these elements from the affinities which hold them bound, and by chemical changes bring them to such a condition as to be solvent in water, that they may nourish the plant, is the system for the farmer to pursue. The laws and causes which govern the wonderful transformation of soil to plants and animals, should be somewhat understood to enable the farmer to employ those that will accelerate this work and avoid those that will not. The frosts in winter, crushing and reducing the rock and soil to powder; the heat of summer, decomposing the organic ingredients; the air permeating with its oxygen to separate its mineral elements; the moisture of the atmosphere descending in rain, dissolves the plant food prepared by these other agencies. Year after year these influences are at work, and plant food becomes available, is taken up by the plant, and when not gathered, then decomposition carries back to the soil all they took from it, with the addition of what the plant derived from the air. Annually the crops repeat this process. "All production is the result of chemical change, which is behind the crop, and is the cause of its growth." Professor Johnson says "this change is like the winding up of a clock which produces the ticking. Our crops are the measure of the effectiveness of these chemical changes." When the cropping process commences and is carried on, things are changed; the plant carries away from most soils faster than the power of production can develop. If yearly cropping for a long time reduces the soil to a condition of exhaustion, crops cease to pay cost of cultivation: when this is the case, leave this reduced soil to the care of nature, and it will in due

time be again made fertile by the original process. There are several natural laws which seem to indicate that a rotation of crops may be effectual in longer retaining the original fertility of soils. Nature seems to adopt a system of rotation in her forest growth, when the elements of plant food taken away are not all returned again for many years. When the pine and spruce have been removed from our mountains, a strong, luxuriant growth of white birch or poplar take their place. When the hard wood forests are removed, if left to nature, their place will be supplied by the pine or hemlock. A forest of any kind of wood, if removed, and the soil left to nature's working, will in time be replaced by some kind, different from that which first occupied the land. The second growth of timber is strong, healthy, indicating that it is well supplied with nourishment; and these facts point with an unerring hand to this law of nature, that plants of different kind or species for their development do not require the same kind or quantity of food elements. Plants, like animals, have different ways of feeding. We grow plants that require the stimulating influence of abundant nitrogen, but need but little of some of the mineral elements; others will not grow and mature satisfactory crops unless they are well supplied with the mineral elements. Some require more phosphoric acid and less potash; some more potash and less phosphoric acid. On a new soil which has a large accumulation of plant food, we may grow a crop of the same kind for several years without the leading elements of its growth becoming exhausted. For example: after the timber was removed, winter wheat grew for several years in succession on the clay soils in the Champlain valley, producing abundant crops with little care and no manuring, but the time came when the leading elements of its growth became deficient, and its yield lessened from year to year until it ceased to be remunerative. When a crop has exhausted the soil of the leading materials of its growth, it may be followed by a crop of a different kind, requiring different elements, or elements in different proportion, and the second crop may flourish just as if the soil had never been cropped. Thus we can raise certain crops at regular periods, relying almost entirely on the processes of nature for their development. Some crops growing on the soil have greater influence in this regard than others. Some crops give the soil shade and protection from the influence of the sun and wind, preserving its moisture and retarding decomposition. Some send fine rootlets to but little depth, and die early in the season; others grow through the season, penetrating with their large, strong roots to great depths, bringing up the fertilizing materials from below, filling the whole soil with their fibrous net-work, and then by decay leave the soil porous, giving it a large quantity of organic material, thus giving it absorbing and retaining powers. A change of crops enables us to secure these different influences, as the soil shall require them to assist the chemical forces in their more rapid development of plant food. While I believe that rotation is one of the aids of which we may avail ourselves to improve the producing power of the soil when the crops are removed, still on most soils no system of rotation has ever been practiced that will enable a farmer to remove crops annu-

ally and preserve its fertility. No system of rotation will be successful in preserving its capacity for production, unless at intervals in the course it be supplied with manure. Some of our interval lands, perhaps, would be an exception to this rule, and some lands will retain their fertility with long periods without manure. The broadest principle of rotation is, to alternate hoed crops with those sowed broadcast; grain crops with forage crops—crops having a short and rapid growth, and which produce seed like wheat and barley, with crops that grow through the season like clover, and is cut for forage without its producing seed. No system of rotation can be devised as the best for all classes of farmers. The locality, soil, tastes of the individual, his market, and the home wants of his family, are circumstances that should influence each farmer in deciding for himself the practical question. Location, distance from market, cost of special fertilizers, make it necessary that an intelligent system of rotation should be adopted to aid nature to sustain the fertility of our farms. A large majority of Vermont farmers are, and probably always will be, stock growers; the effect of this branch of farming, is to carry off less manural elements than the raising and selling grain. Some branches of stock farming exhaust a farm more than others. A butter producing farm is the least exhausted, and can be kept up with less thought, care, and manure. Hay and grass are the staple crops for our stock, and should have the first place in the rotation. A large portion of pasture lands and some meadow lands are not adapted to any system of rotation. Located as many farmers are, I would advise a five years' system. First and second years in clover, third year potatoes, fourth year corn, giving this crop an application of manure; fifth year with wheat, barley or oats, re-seeding to clover again. In this course there would be one-fifth seeded to clover, and one-fifth of clover taken up each year, there would be but one application of manure in the five years, and but one crop, that of potatoes, sold off the farm, the other four to be fed, unless it be a supply of wheat raised above the wants of the family. Now let us look at this five years' system of rotation. Remember that plants like animals have different ways of feeding. The different kind of crops, each have their peculiarities in their feeding arrangements. Some have shallow or spreading roots like wheat and barley, and ripen early in the season, while others like clover and corn have deep-growing roots, maturing late in the season. Clover, as a forage plant, is second to none we cultivate. Its influence on the soil is highly beneficial. In Prof. Johnson's work, "How Crops Grow," he tells us that the earthy matter or ash of one thousand pounds of the different crops we grow is as follows:

Wheat, twenty-two pounds; peas, thirty-one pounds; oats, seventeen pounds; timothy, twenty-three pounds; barley, twenty-two pounds; clover, thirteen pounds.

All the rest comes directly or indirectly from the atmosphere. From this table we see that clover takes less of the mineral elements of plant growth than either of these crops named, but draws part of its nutriment from the atmosphere. So we must look for some other reason why clover benefits land. First, its strong tap root strikes deep into the

subsoil and brings up mineral food that is out of the reach of the roots of other growing crops. Second, its numberless leaves gather and appropriate the fertilizing elements of the atmosphere. Some seem to doubt the power of clover to absorb nitrogen directly from the atmosphere. Whether it does really absorb from nitrogen of the air or not, it is a well established fact that from some source, even when not manured, or following crops not manured, it very readily takes up large quantities of nitrogen and stores from three to four times more in its roots than other crops. At one of the government agricultural schools in Germany the roots of different crops were carefully excavated to the depth of ten inches, and with the stubble were weighed, and are as follows:

COMPOSITION OF ROOTS AND STUBBLE—POUNDS PER ACRE.

	Dry Vegetable Matter.	Nitrogen.	Lime.	Magnesia.	Potash.	Soda.	Sulphuric Acid.	Phosphoric Acid.
Rye	3400	62	60	14	30	40	12	24
Barley	1515	22	40	5	9	3	5	11
Oats	2200	25	81	12	24	17	8	28
Wheat	2440	22	72	10	17	11	7	11
Red Clover	6580	180	246	46	77	19	24	71
Buckwheat	1630	45	75	7	9	4	6	10
Pea	2400	53	68	11	11	7	9	14

This table is the work of careful German experimenters. The six thousand five hundred and eighty pounds of roots of clover, containing one hundred and eighty pounds of nitrogen, is valuable for succeeding crops. This amount of nitrogen is nearly three times the amount that Professor Stockbridge says is necessary to produce a crop of fifty bushels of corn per acre, and seven times the amount that was found necessary by the Connecticut experimental station to produce a good crop of corn. Clover roots reach deeply into the soil, and by decomposition leave fertilizing ingredients to a considerable depth, that induce the descent of the roots of other crops to a point where they are much more sure of a supply of moisture during dry seasons. Clover roots, penetrating deep into the sub-soil, traverse parts not heretofore open to vegetation, and in their decomposition they produce a chemical effect on the inorganic substances that lie along the course and help render them serviceable for the succeeding crops. I believe land on which an abundant crop of clover has been grown is richer, or at least in better condition for succeeding crops even if two cuttings a year, for two years, have been removed entirely from it. Potatoes, corn or wheat, or in fact, almost any crop, succeed finely after clover. If my soil was suitable, and market not too distant, I would have potatoes in the course, and if in the course, would prefer to have it follow clover, because the crop after clover does not need an application of manure; neither should the potato crop have an application of manure if you wish to get good smooth tubers and free from disease. If but one application

of manure is to be given in the five years, it should be for the corn crop. While corn will follow clover finely, it is in its growth more like clover, and, therefore, there should be one crop between that has quite a different power to obtain its food. Professor Atwater, in summing up the results of all the experiments for the past few years, by the Connecticut experimental station, with the corn crop, says, "The experiments thus far imply that corn has the power to gather a great deal of nitrogen from soil or air, or both; that in this respect it is nearer to the legumes than the cereals; that, in short, corn may be classed with the renovating crops. Another important fact was brought out, that the corn plant has in these trials shown itself capable of getting on and bringing fair yields, with small amounts of the more costly mineral fertilizers, even on the somewhat worn-out soil of the eastern states With a small amount of mineral fertilizers, it has gathered its nitrogen from natural sources and holds it ready to be fed out on the farm, and returns it in the form of manure for other crops. A good corn crop, though in itself profitable, offers a good opportunity to bring the soil into a better condition for the production of other grain crops. It's a good crop to kill out weeds. The expense of tillage, and keeping down weeds, should not be charged entirely to the crop because the following crop is benefitted by it. The fifth crop, the only sowed crop in the five years' system mentioned, should be wheat, barley or oats, and circumstances should direct which of these crops to sow. Barley is the best crop to stock with, oats the poorest. Wheat, on suitable soil, will generally be the most profitable, if sold from the farm, but barley and oats will be more likely to be fed on the farm, and if so fed, will return to the land more than wheat. There is but little difference in the requirements of an average crop of these grains. The following table, prepared by the Department of Agriculture, calculated from Wolff's tables, shows the amount of nitrogen, potash and phosphoric acid contained in air-dry, average crops of Vermont.

FOR THE GRAIN AND STRAW.

Average Yield per Acre.	Bushels.	Pounds.	Nitrogen.	Potash.	Phosphoric Acid.
Wheat	18.2	3367.4	29.99	17.15	14.18
Barley	24.2	2105.4	22.18	14.35	10.15
Oats	31.4	2512.0	25.32	23.31	8.23

This table may indicate which of these three crops to sow the last year of a five years' course. Wheat evidently needs the best soil; it takes the most nitrogen and phosphoric acid, the most expensive to furnish soils, while oats require the most potash, an element not lacking in many soils, and inexpensive when needed.

The ravages of insects should be mentioned, because it has an important bearing on rotation and often necessitates the dropping out

of a crop, in any system, for an indefinite pertod. Wheat was grown very successfully for many years after the land was cleared of its forests, but, after a while, the wheat weevil appeared, and was so destructive to this crop that its production was abandoned for several years. After this insect had its day, (as most all insects do) it disappeared, and wheat is again raised and in yield equal to that of an early day. It would seem at one time that the potato crop would have to be abandoned; rot and insects have increased the cost of this crop, but it still holds a place.

The pea bug is another insect that is likely to drive the pea crop from the farm. This crop is a valuable one in certain rotations. The rotation I have spoken of will apply to what we call our plough or tillable lands, but the inquiry may be made, what system shall we pursue to improve our meadows? Many meadows need plowing sooner or later, the periods intervening depending upon soil, location, lay of land and the seasons. Some meadows may be best improved by plowing and re-seeding without taking any grain crop from the land. Most meadow lands can be as well improved by cropping to grain twice, if one application of manure can be made. If the soil is clay, peas are the best for the first crop. The pea is one of the leguminous plants that, like clover, improves the land for a succeeding crop; then follow with some one of the sowed grain crops that will take stocking best, and in re seeding again, I would, on all except low lands, have a two years' course of clover, sowing with the clover seed the seeds of other grasses, sufficient to occupy the land when the clover dies out I think clover improves meadow land for the succeeding hay crop just the same as it does land for hoed or grain crops. When clover will do so much to improve lands in various ways I sometimes wonder why more of it is not sown and raised by farmers. We hear farmers talk of worn out farms, of exhausted lands. I have noticed when such farms or lands pass into the possession of a good manager, an intelligent farmer, how quick these lands are made productive, thus refuting the idea of exhausted farms. Professor Johnson says, "there is hardly a soil in the world that was once fertile that can be truly exhausted, or deprived of the mineral elements of plants." The popular belief that the land throughout the country is becoming impoverished year by year, and that the natural effects of cultivation is to exhaust the soil, is untrue." When visiting different parts of the state, we hear farmers talk about their lands being exhausted, worn out, and unproductive from constant cropping. Lands are called "worn out" when they no longer pay to cultivate under the old system of tillage. "Exhaustion consists in the removal by the crop of those elements requisite for their perfect growth which are in an available condition to be taken up by their roots," that the materials may still exist in the soil, but not in that condition in which the crop can make use of them. All soils contain all the elements necessary for a crop, but not always in an available form. To cure exhaustion, we must change the state of these materials which still exist there, so that they may become avail able, or restore that which has been removed from the soil. We often hear farmers say, speaking of their neighbors' farm, "that is nat-

urally good soil, but it is rather run down." "This land is in poor condition;" or you will hear this remark, "This is poor land, but it has been brought up into good condition." This may be seen with a clay soil, when plowed in the spring and handled in a wet state, and when dry is found hard, lumpy, plant food locked up, not available until by tillage it becomes mellow. There is no farmer, I don't care how much he may lack in good judgment in handling his land at the proper time, or how much he neglects tillage, or how long he may pursue the skimming process of taking from and never returning anything back, he cannot permanently destroy the fertility of his farm. Often we see farms that are worn out, as we say, by a shiftless system of farming, sold perhaps on a mortgage, and when passing into the possession of a good farmer, brought back to a high condition of fertility in a few years, and this change from a worn out to a productive farm was by good management and tillage, by pursuing a good system of rotation of crops. Rotation on soils, and for most crops, seem to be necessary for successful farming. It's not impossible to grow some crops on some soils continually without rotation. We see this in some meadows that have been cropped of hay for fifty or a hundred years, and still producing good crops, without any return of fertilizers, but the tendency in nature is towards rotation.

There is, perhaps, no land in Vermont that may not, by the expenditure of money, be made fertile, but there is a point where the production pays less than the cost, when the value of the crop is less than the interest on the value of the land, the cost of the manure and the labor in its cultivation. Many farmers raise large crops on a few acres of their best tillable land. A large farm may be made to pay tribute to a few acres near the house or barn by putting on these few acres the manure made from all the hay and grain raised on the whole farm. These few acres may be made very productive, but what becomes of the rest of the farm. Every acre, the product of which falls below its cost, is a tax on every acre the product which exceeds its cost. The secret of successful farming is in turning this point of profit on every acre of the farm.

I will not advocate, neither do I believe it best, for farmers in this state to practice intense farming. Intensive farming means to increase the store of its convertible plant food to its highest possible amount, the larger the export of plant food becomes necessary. This farming is practiced near large cities where markets are good, and fertilizers abundant. In intensive farming manure is applied abundantly, the condition of the soil is kept at a high pitch. Here rotation is not necessary, though a change of crops may be advantageous. A market gardener near a large city, where land is worth from three to five hundred dollars an acre, will frequently put on from fifty to seventy-five tons of manure on a single acre, and take off three crops; for instance: fifteen thousand heads of lettuce, twelve thousand cabbage and eight hundred bushels of turnip. The second crop is on the land before the first is removed; the third crop growing before the second is harvested. A Vermont farmer, with land worth from fifty to seventy-five dollars per acre, if he wished to raise this amount

of garden vegetables, could do it with less cost and more profit on three acres than on one. The principal is the same, in relation to all kinds of farming. Extensive farming is better suited to Vermont. We have no high priced lands, no large market easy of access for perishable vegetables; here capital is small, labor scarce and high, and land cheap. We must raise good crops with little expense, instead of large crops with great expense. Here comes in rotation as an indispensable system of good and not expensive farming. Now what has been the result when rotation of crops has been long practiced. Farming in England has been revolutionized by these various systems of rotation; their crops have been largely increased and their lands improved. There are sections in Pennsylvania where thirty years ago farms were unproductive; many of their owners were anxious to sell out at twenty-five to thirty dollars per acre, that now is a beautiful farming region; their farms worth from one hundred to two hundred dollars per acre, and are constantly increasing in value, and this great change in the value of their lands is owing to a system of rotation in connection with the manure of the farm. Their system was a four year's course, first corn on clover sod, second oats, third, wheat with the manure of the farm; fourth, clover to be cut or pastured. Wherever this treatment was introduced and practiced, it secured the most satisfactory results. This may not be the best, probably is not the best, system for Vermont farmers to adopt. There are various objects to be attained by means of a rotation. The most important of these are the improvement of the condition of the soil, and the proper adjustment of the demands for labor. That is, crops should not be raised that require labor all at the same time. Observing farmers know perfectly well that the raising of the same crop (unless it be permanent pasture grasses,) for many successive years on the same land, injures its quality. Not only are certain elements of fertility that the soil contains removed out of all proportion to the quantity of other available elements that the crop requires, but as each crop is attended by its peculiar weeds and peculiar insects that change becomes necessary to eradicate or destroy. Therefore, we should constantly aim to so alternate one cropping, that while this year's crop may make an excessive demand on one element of the soil, that of the next may require less of this ingredient and more of some other. Farmers should observe the principles upon which the necessity of rotation is based, and deviate from any fixed system or course as his location, soil, taste, market or various circumstances may direct.

RAISING CORN IN NORTHERN VERMONT.

By E. R. TOWLE, Member of the Board from Franklin.

I do not take up this subject with any intention of adding to what has been said heretofore, or for the sake of coming in contact with the opinions of others, but merely to give my experience and observation in the matter, and perhaps speak of some methods of culture that appear to be especially adapted to the production of this important crop in the more northern part of our state, or in those places where the season is more or less unfavorable. And here I would say that I live but a few miles south of Canada line, yet in this section, upon both sides of the "border," from Missisquoi Bay far to the east, there is excellent corn land, and good harvests of this grain are usually secured.

Next to hay, I consider corn the most important crop for Vermont farmers to raise, at least where its production is reasonably successful. The grain is a useful and economical food for both man and beast, being wisely adapted to a great variety of purposes, while the stalks, if properly cured, make excellent fodder. But the crop itself is not all that is to be taken into account in the consideration of this subject. For some reason, a well cared for field of corn is an excellent preparation for any other crop the farmer may desire to raise, whether of grain or hay. The fertilization given, followed by a thorough cultivation, and perhaps the mechanical action of the roots on the soil, all tend to a better condition of the land. On our Vermont farms, where good crops of corn can be raised with a reasonable outlay, it is safe to say that most any other crop will flourish. Corn will suceeed in a large portion of the state, and but few states will exceed our yield per acre. It costs more to raise corn here than at the west, yet when the money value of the crop is considered, the true criterion by which to judge, we shall be found first, not second, on the list.

The farmers of Vermont probably feed twice the amount of corn, or its equivalent in other feed, that is produced at home. If more corn was raised, in this way not only saving of the outlay for the western product, but gradually improving our farms meanwhile, a double object would be gained. As it is, our farms average considerably less than two acres devoted to this crop. Of course there are some farms, and perhaps small portions of the state, where it would not be advisable to attempt to raise corn; but where it will succeed with a fair share of attention, no farmer should neglect its production.

PREPARATION OF THE SOIL FOR THE CROP.

In my practice, I usually plant corn on greensward, and like to turn it over in the fall to save work in the spring, and so as to be in a condition for receiving the manure which is principally drawn in the winter. I always aim to have the ground well plowed, so as to save time and labor in cultivating, and from six to eight inches in depth, according to the nature of the soil. If well turned over, the snow will press the furrows down smoothly, so that little or no grass will spring up between them, and they will not be likely to be torn up in harrowing. As to manuring, where this is done broadcast, as is quite largely practiced, at least in the northern part of the state, it is commonly drawn out in winter and put in large heaps to be spread just before planting. Some farmers still persist in putting the manure in small piles, about four to a load, a practice that cannot be too strongly condemned. Where the manure does not contain very much coarse material, and circumstances will admit, I think the better way would be to spread where wanted as fast as drawn to the field. Where the manure is somewhat coarse, putting in large heaps and handling over a second time has a tendency to improve its condition. Where too coarse, would not use for this crop unless it were to be plowed under. I prefer to put the manure on the surface, although now and then a farmer will have good success in plowing under. Would harrow the ground thoroughly, so as to mix the manure with the soil as much as possible. It is cheaper and easier harrowing than hoeing, therefore would do this work well. The amount of manure to the acre will depend on circumstances. In my part of the state a favorite, and I might say general, rotation practiced, is corn on greensward, and then stock down to grass along with wheat, oats or barley, to be followed with grass as long as paying crops are obtained, or until it is desirable to plow again. If, as is sometimes practiced, all of the manure is applied to the corn crop, some twenty loads or more per acre is applied, with ten or twelve loads in the hill; or instead two hundred and fifty pounds of superphosphate. Most farmers use manure in the hill; indeed, this is a necessity on all or nearly all of our land. I am aware that this requires more labor, but it pays, as it must add from twenty-five to one hundred per cent. to the value of the crop. Of course there are some soils of such a character, or so favorably located, as to produce good crops without anything in the hill, but as a general thing it is not safe to attempt this. However well the land may be manured broadcast, so far north we find it necessary to put something in the hill to give the crop an early start.

Being a dairy region, a large number of hogs are kept and a good amount of manure is made from this source, and this on well managed farms is materially increased by the addition of horse manure and other materials, which are worked over and thoroughly mixed with their own excrements by the swine, thus making one of the best fertilizers for corn. In this way many farmers make sufficient for all the corn they wish to raise, and it is getting to be the practice to omit the broadcast application, and only manure in the hill. Strange

as it may appear to some, this method of applying manure appears to work well. There is one very important advantage in this method with our rotation, and that is that the manure generally spread on can be used the following year when seeding down to grass, thus insuring a better catch and more satisfactory crops of hay for a longer period afterward.

In my own practice would like about twenty loads of stable manure spread on and two hundred and fifty pounds of superphosphate in the hill. Use all the hog manure I can make in the hill, but would prefer, if I could spare it, to have ten or twelve loads of stable manure spread on and harrowed in. If any should ask if *all* of the manure used were to be spread on it would not do as well? I should answer no, decidedly, not on my soil, which is mostly a gravelly loam and generally well adapted to corn. From my experience I am satisfied that manuring in the hill will double the crop of corn in value over broadcast application alone.

SEED AND PLANTING.

In the selection of seed, I would seek for earliness first, as this is very important with many, and a week or ten days in ripening may mean success or failure of the crop, and in the next place a kind that will give the largest yield of merchantable corn that can be obtained with the required early maturity. Would not plant until the ground becomes so warm that there is a reasonable prospect of germination and growth. Planting early for the sake of having the work out of the way, or of getting ahead of some one else, unless the ground is in a suitable condition, will be poor policy in the end. Neither would I delay planting when the conditions are all right, because the right date in the calendar had not arrived, or the moon was in the wrong quarter. Would have the rows straight and of a width to correspond with the size of corn to be planted. Where manure is to be put in the hill, it should be well covered before planting the seed. Where a concentrated fertilizer is to be used, it should be well mixed with the soil to prevent injury to the seed.

I am of opinion that good, honest fertilizers have been denounced as worthless solely from carelessness in using. Would use the planter or hoe as is desirable. I have no trouble in planting with a machine where manure or fertilizers are put in the hill, yet I consider this part of the work of much importance and would always have it well done. Planting where manure or fertilizers are put in the hill incur increased labor, but on our farms it pays where only from two to four acres of corn are raised; perhaps it would not in some parts of the state, or where large areas are devoted to the crop.

CULTIVATION.

Under this head I need say but little. The weeds should be kept down and the soil in a light, mellow condition. As much of the work as possible should be done with the horse, but I shou'd not hesitate to use the hand hoe when needed. Cultivate as long as necessary, or there is time for the work.

HARVESTING.

As the fodder from an acre of corn should, if well secured and at the right time, be worth as much as an average crop of hay, it is important to pay attention to the harvesting. If the corn is cut up at the roots after the grain is fairly glazed and while the stalks are yet quite green, and well cured, the fodder will be of the finest quality and the grain all that could be desired.

The past season was very late and an early frost injured some fields badly, but mine being favorably located escaped with only a slight touch, and being quite green when harvested and well cured, I had an excellent quality of fodder, just the kind to feed late in the fall and winter. When harvesting I would not advise making a whole stook into one bundle, that will want two men to put on the wagon, one to load and another to halloa, but would bind in moderate sized bundles, easy to handle, and put six of these in a stook, where they will cure nicely.

SAVING SEED.

This is a very important matter and requires careful attention. Corn can be kept up to an average standard, or even improved, by a continued and judicious selection of the seed. When this is carefully attended to, there will be little necessity for a change of seed, if a desirable kind is in possession.

If earliness is especially desirable, the seed should be selected before the corn is cut up, when the ripest ears can be easily found; but if a greater size and more uniformity of ear is wanted, this can better be secured at husking time. It may sometimes happen that a farmer will have a variety of corn every way desirable, only a little too late. Persistent selection of the earliest ripened ears will make a gradual improvement in this respect, without very much deteriorating the yield. Corn traced and hung in a dry, airy place will cure well and seldom fail at planting time.

PUMPKINS WITH THE CORN.

I am aware that many object to planting pumpkins with corn, claiming that the vines are always in the way, thus causing extra labor with little profit in the end; but I consider a good crop worth securing and excellent to feed to cows in the fall and to fattening animals. I would not have the vines too thick, but would pull up all surplus ones at hoeing time. They do best where manure is used in the hill. Pumpkins can be improved by saving seed from the best specimens. The extra labor of raising this crop is in the harvesting, and I consider them worth from one to two dollars a load for feeding. From ten to twelve loads per acre may be considered a good crop.

KEEPING OFF THE CROWS.

These birds are becoming very numerous and troublesome. I had much difficulty with them the past season, and was ready to vote them a perfect nuisance. They were cunning, crafty and wicked.

The field was strung with twine, but did no good. Images were put up, one hung so as to swing, the other surrounded with bushes; but they would come down close by and pull the corn. Corn was scattered about the field and in the pasture adjoining, but the black rascals would eat that up in the pasture, let that alone in the field, but would pull up the planted corn within two feet of it. They were even so mean as to pull up some of my best corn and then leave it without eating the kernels, and after it was replanted would follow the rows as straight as a gun and dig out the corn before it had a chance to come up. Seeing that I was likely to lose my crop to a great extent, that had cost me so much labor and care, unless something more effective was done, my son finally succeeded in shooting a few of the pirates, and these were placed on the ground with wings outspread, as a warning to the rest. This had the desired effect, and the field was saved from further molestation. Some of my neighbors were wiser than I, putting on dead crows at the time of planting, and by this means saved their fields from injury, while I, trusting to moral measures, suffered for my confidence. Henceforth, dead crows will guard the corn-field from the living depredators, while the stringing, image making and corn sowing of other years will have a rest. The crows should not be hung up, but laid upon the ground with wings spread out.

EXPERIENCE WITH COMMERCIAL FERTILIZERS.

I have used commercial fertilizers, principally superphosphates, for seventeen years, and generally with good success. My practice usually is to spread manure on the surface, and put the fertilizers in the hill. I use all the hog manure I can make in the hill, and finish with superphosphate. The hog-manure will produce the largest growth of stalks when there will be little or no difference in the yield of grain. The phosphate will stimulate an early maturity of the crops, an important consideration. Should not like to undertake to raise corn with phosphate alone, although this might do on some soils or in a particularly favorable season. Where this is attempted the larger portion should be lightly harrowed in and the remainder put in the hill. Several years since I conducted a series of experiments with the Matfield, a special fertilizer for corn, Bradley's X. L. superphosphate, and farm manures, on several plots of ground of one eighth of an acre each. I used the Matfield at the rate of 800 pounds per acre, mostly broadcast, with a small portion in the hill, at a cost of $19 per acre; 432 pounds of the X. L. per acre, at a cost of $10.40; Matfield, 480 pounds per acre, broadcast, and 168 pounds of the X. L. in the hill, at a cost of $24; stable manure, twenty loads broadcast, per acre, and with X. L. in the hill, cost $14; stable manure spread on and hog manure in the hill cost $20.

Soil, greensward, a gravelly loam and otherwise treated alike. Corn weighed when husked and eighty pounds allowed for a shelled bushel. The result was as follows: The Matfield gave at the rate of 35½ bushels per acre; the X. L. 43 bushels; Matfield and X. L. 44 bushels; stable manure and X. L. 60½ bushels; stable manure and hog manure 61½ bushels.

The plat with the Matfield alone was a week or ten days later than the others, and the growth of stalks smaller. The percentage of phosphoric acid was small, and to this I attribute to a great degree its falling so far behind the others in growth and yield. With a trifle over one-half the amount of the Matfield—when used alone—and a small quantity of the X. L. in the hill, the yield was largely increased. But as will be seen the plat with the manure and the phosphate did much better and was very nearly equal in yield to the plat with stable and hog manure, and at considerable less cost. The season was dry. A small plat had no manure or fertilizer, and could not have produced more than twenty or twenty-five bushels to the acre, and one-half of that soft corn. From these figures and those that may follow, it will be seen why I am in favor of using superphosphate as far as possible in connection with manure, and I have lately noticed that several writers advocate the same practice.

Some ten or twelve years ago I made experiments on corn with several kinds of fertilizers used in the hill. Crop otherwise treated as mentioned in first experiment given. Season wet. Weight of one row of corn at husking time:

With nothing in the hill, nearly half soft	31 lbs
Stevens' Fertilizer	35 "
Coe's Superphosphate	63 "
Hog Manure	69 "
Green Mountain Soluble Phosphate	72 "
Cumberland Superphosphate	77 "
Bradley's X. L. Superphosphate	79 "
Hog Manure and Bradley's	80 "

Here will again be seen what kind of a yield I should be likely to get with nothing in the hill, and also the comparative value of the Stevens fertilizer, that was ground up out of New Hampshire rock, and sold to our Vermont farmers at a good price, with which to improve their soils. When used on potatoes it gave a less yield than where no fertilizer at all was employed. It will also be noted that several of the superphosphates gave a greater yield than the hog manure, and that the addition of the usual amount of superphos phate *with* the hog manure, gave only one pound more than the phosphate alone, and eight pounds more than the hog manure.

The manure broadcast and either the hog manure or phosphate in the hill, appears to be what will give the best results on any land.

Any one interested in the last experiment given, will find in the report of the Board of Agriculture for 1874, a much more detailed account of my experiments with fertilizers than I have room for here. One of my neighbors last season had excellent fields of corn for so unfavorable a year. Manure was harrowed in on invested greensward, and hog manure put in the hill. On a part superphosphate was put on at first hoeing. It was found at husking time that where the application was made the corn was much the best, which differed from my experiment of this kind. Another neighbor a few years since wishing to use a hand planter did not dare to put superphosphate in the hill in the usual way, for fear of injuring the seed, and instead made the application at hoeing time,

covering it up as soon as possible. It was put around the hill of corn the same as ashes, and although a poor season he had nice, sound corn.

The last season I made a small quantity of acid phosphate, after the formula given by our secretary, using for the purpose one barrel of fine ground bone, three gallons of acid and two hundred pounds of land plaster, making about five hundred pounds in all, at a cost of $36 per ton for the materials. A large quantity, and with acid at a cheaper rate, should make the cost somewhat less. I tried this on corn, in connection with several other kinds of fertilizers, so as to be able to judge approximately of their value. Soil, greensward, in very fair condition, plowed last fall, with perhaps fifteen loads of manure harrowed in. Two rows were devoted to each fertilizer in the hill. Planted May 26, and followed with a long rainy time, so very bad that I feared the value of the fertilizer would be seriously impaired or the germination of the seed injured. Of course the best results could not be obtained under such disadvantages, yet they were much better than I was afraid they might be under such unfavorable conditions. When husked, the product from each fertilizer weighed as follows:

	Sound Corn.	Soft Corn.	Total.
Bradley's X. L.	109 lbs.	32 lbs.	141 lbs.
Quinnipiac	115 "	33 "	148 "
Soluable Pacific Guano	116 "	36 "	152 "
Buffalo Fertilizer	122 "	30 "	152 "
Acid Phosphate	114 "	41 "	155 "

I believe that it would be difficult obtaining a more uniform result than this from the number of fertilizers given. About ten days after the above was planted, the larger part of the remainder of the field was planted with only hog manure in the hill. Two rows of this gave of sound corn ninety-three pounds, soft corn twenty-four pounds, total one hundred and seventeen pounds. This would be only at about six bushels to the acre less than was produced by the average of the plats with manure spread on and fertilizers in the hill. Several rows with no manure broadcast, only the Buffalo fertilizer, Bradley's X. L. and the acid phosphate gave not more than half a crop. Here the acid phosphate did not do nearly as well as the others, indicating that something more than phosphoric acid was needed.

Now a few words in relation to acid phosphate on my land. Its results on corn, both with and without manure spread on, have been given. Where used on potatoes without manure it did not do as well as the other kinds mentioned, but on an old pasture, when mixed with an equal bulk of wood ashes, it did as well or better than Bradley's, and at less than half the cost. Where sown on land seeded to oats, in connection with ten loads of manure to the acre, the yield was as good as on another piece where Bradley's was used. The crop on both pieces was very good. Where used on fodder corn in the hill, with no manure, it fell considerably behind the other kinds. From these trials I am led to infer that the acid phosphate will pro-

duce good results for me on corn and the English grains when used in connection with manure and on potatoes, when mixed with wood ashes; but to use it alone would not appear to be advisable. Another trial might vary the result, while on other soils, or in different localities, the conclusions might be very different, thus indicating most plainly that the best and only true way to decide the matter satisfactorily will be for each farmer interested to try for himself, as has been so often advised by our Secretary.

EXPERIENCE WITH FODDER CORN.

Last year I planted an acre to Sanford corn about June 10. The season was so wet that it was difficult getting the seeding done in anything like proper condition. The land was greensward plowed the fall before. No manure was applied, only fertilizers put in the hill. The rows were made about three feet apart and the hills about two feet. The superphosphates—there were several kinds used—were first covered, mixing somewhat with the soil, and the seed put in with a hand planter. The field was cultivated and hoed once, and a top-dressing of ashes used. A little was drowned out entirely, but the rest grew finely, was of a dark green color and attained a large, vigorous growth, and part was used green for the cows and the remainder cured for winter, and made the best kind of fodder. If the piece had been sowed to oats there would not have been half a crop, it was so wet, and the same would have been the case if the corn had been sown broadcast instead of being planted.

From my own experience and observation, I would plant soiling corn and not sow. Would plant quite thickly, have the rows straight, and cultivate twice at least. I like the Sanford corn as it gives a good leafy growth, is sweeter than the western varieties and seems so well adapted to the purpose. As it was not necessary to have the crop mature for grain, I find it can be successfully grown with only fertilizers in the hill, and may be planted after the usual spring's work is done, if necessary. In this way it can be easily raised and a large amount of fodder secured to be used either green or dry, and at a comparatively cheap rate. It is also much more readily harvested than when sown broadcast, is of far better quality, being more matured and containing a greater amount of ears.

In conclusion, I think we should raise more corn, both field and soiling, cultivate well, thus fitting the land in the best manner for succeeding crops, and help to save the large outlay that has been made for grain and feed in the past.

OUR POTATO CROP.

By E. R. Towle of Franklin.

I had supposed that corn was second only to hay in importance as a farm crop in Vermont, but I find on investigation that the money value of the potato crop is greater than that of corn. Still I consider corn the most important crop, all things considered, as in statistical reports the value of the fodder is not given, which would amount to a considerable sum, while as a general thing the land is left in a better condition for succeeding crops after corn than potatoes.

While we raise only about one half of the corn that is required upon the farm, there must be a considerable surplus of potatoes for sale. I find that our little state of Vermont is the eleventh in the point of production of all the states in the Union. In 1880 the total production of potatoes was 4,954,740 bushels, raised on 35,140 acres of land, an average of 141 bushels per acre. This would be 139½ bushels for each farm, a trifle less than one acre, and nearly fifteen bushels for each inhabitant of the state. The average price that year was forty two cents per bushel, for the entire country, making a total of $2,080,791 for the crop. The corn crop for that year was valued at $1,279,136, a much smaller figure, as will be seen.

In 1881, the most disastrous season, it has been stated, for potatoes throughout the whole country, the yield was only about one-half that of 1880, and the money value even greater. That year, for the first time, large quantities were imported from abroad to supply the deficiency in this country.

I should judge that the yield of 1883 must be considerably larger than that of 1880, of unsurpassed quality and from the over-production commanding but very small prices.

So much for the figures so far as may relate to the extent and value of this crop in Vermont. In my part of the state comparatively little attention is paid to the raising of potatoes for sale, other crops taking precedence. It is probable that this crop does not succeed as well in Franklin and Grand Isle counties as in the southwestern part of the state, where the soil is favorable, nor yet in the northeastern portion, where large and profitable crops are raised. Potatoes have not appeared to produce as well here since the rot first made its appearance, some forty years ago. Previous to that time large quantities were raised with comparatively little labor, for the surplus of which there was little demand beyond the starch factories, and they paid small prices. I have heard it stated that the rot was a benefit in one re-

spect, as it turned the attention of farmers to the production of other and more remunerative crops. However true this might have been at that time, its application would not be the same now, although I am of opinion that, if largely raised, potatoes must be an exhaustive crop where principally sold off the farm, unless particular attention is taken to keep up the fertility of the soil by some means outside of the crop. From inquiry and observation I find this generally to be the case throughout the state.

THE SOIL AND ITS PREPARATION.

Not all soils are naturally adapted to the production of potatoes. If any crop needs a suitable and well prepared soil it is this. I can remember when the best part of the field was taken for corn and the poorest for potatoes. This is a mistake; not that I would advise a change right about, but would rather endeavor to have a soil suitable for both.

The ground should be moderately dry, as an excess of moisture will injure both the yield and the quality of the crop, and as well prepared as for corn; that is, mechanically. Potatoes do not require so much heat as corn and will perhaps do better on land sloping somewhat away from the sun. Gravelly and sandy soils if not too dry are good, as also are those of limestone and slate formation, and in some instances a small admixture of muck or black earth helps to produce a good yield.

Land should be plowed moderately deep for potatoes, and pulverized well, so as to afford plenty of soil for the crop, that can and should be planted considerably thicker than corn. In my practice I usually plant on greensward turned over in the fall, but I find that some prefer ground that was devoted to a grain crop the previous year. The kind of land best adapted to the purpose should be used, as the conditions of the soil may have much to do with the prevention of injury by worms and insects, as well as a healthy growth development and amount of yield. A clover sod would be excellent for the purpose, and would not need much fertilization. Continued planting on the same field is generally not advisable, as the quality will not usually be as good, while there would be a greater liability to disease. Often in the reclamation of pastures potatoes can be raised to good advantage, getting a very satisfactory yield of excellent quality, while at the same time the soil will be benefitted in its mechanical condition by good cultivation.

I believe that at present it is generally conceded that green, unfermented manures are not the best for potatoes. They may, indeed, produce a large growth, but of inferior quality and with a greater liability to disease. A moderate quantity of fine or well rotted manure spread on and harrowed in would do well in connection with a good commercial fertilizer in the hill. I have used the last exclusively for a number of years and with fair success, but have come to the conclusion that the usual amount put in the hill—a tablespoonful—is not sufficient for the best results, and that there should be some sown on and lightly harrowed in, or a small amount of manure used in the same manner.

I have noticed of late that in the agricultural press, commercial fertilizers are being largely recommended for use in the growing of potatoes, as more likely to produce a crop, perhaps not as large, but of better quality and less subject to disease than with farm manures.

SEED AND PLANTING.

If especially for home use, I would choose the best kinds, all things considered, to be obtained; if for market, the varieties most in demand, if adapted to the locality where raised. In consulting the market reports it will be noticed very quickly which are the favorites; but perhaps those not quoted quite so high will give enough better yield to more than make up this difference, or else will be better adapted to the locality. These things should all be taken into consideration in the selection of varieties for the market, as the most money for the crop is what is wanted. For home use quality should take precedence of quantity. There should always be one or more choice early varieties, and also some that are later for long keeping. Unless for experimenting the fewer the kinds the better, provided they answer the purpose. There are a great number of kinds from which to select and more are being added to the list every year. Some, like the Early Rose, have preserved their excellence for a long time, while others have but a short life.

There is much being said now in regard to the seed for planting. As far as relates to the size of potatoes used for this purpose, it appears to me that the opinions expressed are about equally divided between large or medium and small potatoes, but I think it is pretty generally conceded that the potatoes used should be cut to a greater or less extent before planting; many say to a single eye.

If the maxim holds good that "like produces like," then it would seem that the continued planting of small potatoes must result in a gradual deterioration of the crop. This may not be very evident the first or second year, or when the conditions for a crop are unusually favorable, but I certainly would not advise the continued planting of small potatoes. I would select medium sized tubers, smooth and of good shape, and then cut in as many pieces as may seem desirable. If planted whole there would be a large amount of vines and too great a proportion of small potatoes. It will be noticed that in cutting to single eyes there will be but few potatoes and generally of good size. For field culture I would not cut to single eyes unless with a new or scarce variety, but would make several pieces of each tuber. By this method there will be considerable saving over the old way of using from twelve to fifteen bushels per acre, and I believe the results would be better.

I think it would be an excellent plan to select the seed for another year at digging time, taking only from those hills containing the largest number of good potatoes, as all have doubtless noticed that some hills yield twice as many as others. In this way I believe a variety of potatoes should be kept well up in yield and unimpaired in quality and vigor. A change of seed from one kind of soil to

another, if of the same variety, is also often times advisable. A Vermont experimenter once had so great a demand for a new variety of potatoes at a large price that he disposed of all fit for sale and planted the culls. It took several years to regain what had been lost from planting such unsuitable seed. We should avoid sacrificing future prospects for small present gain as far as possible to do so.

If it is desirable to have potatoes a week or ten days earlier than they can be obtained by the usual method of planting, this can be done very easily and without cost, by simply taking a box and placing therein alternate layers of garden mold and potatoes and leaving them in a warm place for a couple of weeks before planting time, watering occasionally. In this way the seed will get a fine start and after being carefully planted will come up in a few days and be large enough to hoe by the time those planted in the ordinary way will be coming out of the ground. I give my own experience as authority for this statement and find it confirmed by others.

For planting I would mark off the rows three feet apart, and put the hills from a foot and a half to two feet, according to kind of seed planted, or the habits of growth of different varieties, there being a good deal of difference in this respect. If the gound is moderately dry I would make a shallow furrow in which to drop the seed and cover quite deeply. Would put a good superphosphate in the hill, or a mixture of dissolved bone and good wood ashes. This should be scattered somewhat in dropping and covered or mixed with the soil before the seed is dropped.

Putting fresh horse manure in the hill used to be practiced to some extent, but I think the phosphates are now more generally used for this purpose.

CULTIVATION OF THE CROP.

The old rule used to be once hoeing for potatoes, and that is what they most generally get now, but more attention to this part of the work will certainly be found to pay. Potatoes are usually a long time coming up, especially if planted early, and if left until late before being hoed the ground will, in most cases, become hard and weedy. If planted in furrows as spoken of, a light smoothing harrow can be run over the ground before the tops are in sight, mellowing up the surface and checking the growth of weeds. Some say this harrowing may be continued until the tops are six inches high, with much benefit. If this is not practicable, run a cultivator through early in the season and not hill up until later. If any manure or phosphate has been spread on broadcast, this hilling process will bring it up around the roots where wanted to perfect the crop. Previous to the second hoeing it is also well to put around the hills a dressing of ashes, as considerable potash is needed by this crop. On some soils land plaster will also produce good results when used in this way and is a cheap fertilizer.

It should be the aim of the farmer to keep the crop clear of weeds and grass and the soil in a fine, mellow condition throughout the season ; this for the benefit of the crop, the land and the facility in digging. As much of this work as possible should be done with the

horse and suitable implements, leaving little of the cultivation to be performed with the hand hoe.

BATTLING THE BUGS.

The labor of raising potatoes has been considerably increased since the Colorado beetles made their appearance. Although we have found out a successful way in which to deal with these pests, still they are a disgusting nuisance, and must be dealt summarily with and in season, or the labor of the husbandman will be but poorly rewarded. I have noticed fields of potatoes the vines of which had been almost entirely stripped of foliage, greatly injuring the quality and the yield. No good farmer will permit this wholesale spoilation of his crop. Whether the beetles have come to stay is uncertain, but of one thing we may rest assured, there must be decisive action while they do remain, or there will be little use in planting potatoes.

Although there may be some objections to using active poisons for ridding the vines of the bugs, yet it is the only effectual means of destruction yet discovered, and with reasonable prudence and care need not be dangerous. One or two applications of Paris green or London purple, will usually clear the vines if in season. Some prefer using Paris green with plaster to the more common method of applying with water. Used in this way dusted on the vines, the plaster acts as a fertilizer, and is advantageous. One pound of the green to a bushel of the plaster thoroughly mixed are the proportions generally used. Care should be exercised in not getting on too much, as in such cases the foliage will be injured. I think this would be the case more generally when used with water than plaster, as the green does not become soluble and may thus be unequally distributed.

OTHER ENEMIES.

Aside from the potato bugs this crop sometimes suffers seriously from grubs and wire-worms. Perhaps there is not very much that can be done to avert this beyond a judicious selection of soil, rotation of crops, etc. I think that grubs are more likely to work on greensward than old ground, and when plowed in the spring than in the fall. Only occasionally is trouble experienced from this cause, and I think that plowing late in the fall, just before the ground freezes would be of benefit.

Wire-worms are very hard to deal with, and if known to be largely in the soil it should not be devoted to potatoes, as they will injure a crop very seriously, sometimes utterly ruining it for merchantable purposes. Better devote to some other crop than undertake to raise potatoes on such land.

THE ROT.

After the farmer has done his best to secure a good crop and the prospects are promising for a successful result, oftentimes his hopes are doomed to sudden disappointment as he sees the blight make its

appearance and spread rapidly over the field. No watching, no labor, will prevent its appearance or stay its advance. If the crop has become mature little or no loss may ensue, unless the rot follows the deadly blight, and then there is no telling what the end will be. If the rust strikes a field when the tubers are half grown, further development is at an end, little more growth or maturity can be expected.

As to the rot, its causes and prevention, if indeed prevention there be, beyond a judicious selection of soils, application of fertilizers, etc., I leave to wiser heads than mine to investigate and determine. Early planting, so as to allow the crop to mature so far as possible before the blight makes its appearance, is suggested as a good method and is worthy of attention.

HARVESTING AND MARKETING.

As a general thing potatoes are fit to dig when they are fully ripened, and remaining longer in the ground is often at the expense of quality. I know that it has been a general practice to let potatoes remain in the ground until quite late before digging, probably from custom, or the idea that the crop would keep better here than in the cellar, but as a usual thing I think it would be better to dig earlier in the season. Of course when dug early they should be kept in as cool a place as possible, and shielded from the light. If rotting slightly I think it would be full as well to dig, spread and properly care for. If rotting very bad it might be better to let remainin the ground until later.

As to marketing I consider the best time to be when a fair offer is made, provided it is when the crop can be moved. If this should be at digging time when the potatoes can be shipped directly from the field, considerable labor will be saved and perhaps some inconvenience avoided. If put in the cellar there is a greater or less liability of loss, besides the natural shrinkage of about ten per cent., while if marketed in winter it is at increased expense and with some risk. After putting in the cellar it requires a considerable advance in price over selling directly from the field where this can be done, which should always be taken into consideration by the farmer.

OUR HILL FARMS.

By Hon. E. R. Pember of Wells, Member of Board.

Vermont is pre-eminently a "hill country," and all questions involving the consideration of agriculture in any form must recognize this peculiarity of conformation as one of the principal factors in determining their solution. The "original Vermont plow," impelled onward by the forces of the frozen north, did excellent service in preparing the soil for the future husbandman, a service far beyond the power of man to accomplish. Still, when we observe the rough condition in which much of it was left and see the debris scattered all along its track, with traces here and there of former moraines, we are led to regret that the force of glacial action was so soon spent, and wish that the sharp prominences and numerous boulders might have been again subjected to the wonderful leveling and pulverizing power of Nature's plow. Land, alluvial or moderately rolling, free from obstructions and ready for the plowshare of the husbandman, is sure to ever be in demand so long as earth's teeming millions are to be fed and clothed. But how to successfully deal with land, rough and incomplete and broken, as left by the great preparatory agency, is the question of practical importance to the large majority of Vermont farmers. Machinery cannot take the place of hand labor here only to a limited extent, and when, from any cause, labor fails to reward itself, abandonment must be the result. If on the other hand, our hill farms can be made to pay, then, with the larger remunerative capacity of farms more favorably located, the future of successful agriculture in Vermont is assured.

As my experience and work as a farmer has been wholly with hill farms, I purpose to speak particularly of them, and "what I know of farming," either practically or by observation, will be taken from that standpoint. Perhaps a brief glance at our Vermont hills as they appear to-day, contrasted with their condition a generation or two ago, and a review of some of the causes leading to this difference, will not be wholly uninstructive. The observing traveler, passing through any county in the state will notice many well kept farms and tidy, comfortable homes, but at the same time he will not fail to see in the older settled portions many evidences of decay and desertion. The crumbling ruins of the foundations only are left to mark the site, or perchance it may be that the tottering well sweep and perennial lilac bush still stand as mementoes of once happy homes, where families were born, reared, and went forth to do valiant service in the battle of life. For aught we know, they left the old hearthstones, not from any want of affection therefor or inability to obtain a sustenance from the unwilling soil, but rather because other

localities seemed to offer greater inducements, and when the surplus of population began to look for other homes, the tide of emigration which had formerly spread over these Vermont hills from Connecticut and Massachusetts, took a westward turn, and many a farm and even whole neighborhoods were almost entirely deserted. Natural causes, too, have combined to render our hills less desirable and valuable now than they were at an earlier period. The first settlers had little capital save strong muscles and an iron will, and while carving a farm out of the wilderness and making a home for their families, were compelled at the same time to obtain the necessaries of life from the soil. Hence they would seek to select those portions which would give the quickest returns. This took them to the hills, on which a crop of grain might be grown the first year after the removal of the timber, and though the soil might prove to be rocky and shallow, still it served to produce good crops for many years. In many localities with which I am familiar, all of the intervale land, and most of that in the valleys which is now most valuable, was to the first settlers entirely worthless so far as being capable of supplying their present needs, while what is now but rocky pasture, worth only a few dollars per acre, was then the fertile fields from which all the wants of the family in food and clothing were supplied. Lines of travel have changed somewhat and become fixed. These naturally run through the valleys and tend unfavorably to make the more distant hills desirable places of residence, for social and economic reasons both combine to make easy and rapid communication with neighboring communities and with the world at large, desirable and valuable, so that location and accessibility go farther in determining the price of land than the intrinsic value of the soil itself.

No where in the state is this desertion of farms so noticeable as in the older portions of the southern part, along either slope of the mountains, particularly in Windham County, where many farms and even whole school districts are left without an inhabitant, and now used, if at all, for pasture. It would appear from these facts that the problem of successful farming among *these* hills had been tried and found incapable of favorable solution. As we contemplate this and attempt to read the future by the light of the past, the question arises, how long is this to continue? Will the same process be repeated until the larger part of state becomes again like the forest primeval, and only here and there small portions about the towns and along the routes of travel be kept under cultivation? I do not believe such will ever be the case. Very few of the 35,000 farms in the state that do not contain some land that will be profitable to cultivate if rightly managed, and, *if profitable*, some one will be found ready to do it. It is not wise to discard the whole because a portion is not desirable. It is Nature's law of compensation the wide world over to intermingle more or less the pleasant and the unpleasant. Good and evil are never found wholly separated, and Vermont is no exception to the general rule, for no place of any extent can be found so deficient but that it has some compensating advantages. Do not these facts suggest a change of management adapted to the changed conditions? If a portion only can always be counted as profitable, the question will be

asked, what shall be done with the remainder that all may be made useful? It is true at the present time there are thousands of acres all over the state which, in their present condition, are of very little value. Made up as it is of almost barren rocks, soil filled to overflowing with stones and boulders, hillsides steep and inaccessible, so that reclaimiug by the plow is impossible, and what little vegetation there is seems hardly worth the necessary effort of the stock to obtain it, the question becomes a pertinent one, if it is not profitable to keep this land inclosed for pasturage, what shall be done with it? There is but one use that can be made of such land which promises any adequate return, and that is to let it grow up to forest. It was once covered with a heavy growth of timber, and time will so cover it again if given the opportunity. If this is done many a farm in the state will ultimately be improved thereby, and much land which is now of doubtful value and growing yearly less and less productive, will become actually valuable. It may seem a long time to wait for a crop of wood to grow in this impatient age, but I have no doubt there are thousands of farms in the state which contain land on which this might be made the most profitable crop. To illustrate. As we can not look for immediate returns from a venture of this kind, we will consider it in the nature of a permanent investment; something like a savings bank, and here we need have no fear of dishonest officials, for nature always holds herself ready to return all she receives. We will take, for example, twenty acres of this class of land and set it apart. There is no expense connected with it, save a trifle for taxes, and we have invested $100, more or less, and usually less. Let it stand twenty-five years, and then from time to time we may draw the accumulated dividends in the shape of wood and timber, and the land, instead of being impoverished by cropping of this kind, is improved. There is good reason to believe that investments of this kind will show a larger per cent. gain than the average savings bank. We have thus far looked only to direct results, but there is another feature well worthy of consideration in this connection which has as yet received very little attention in this country, and which may, after all, by the certainty of its indirect results, be the one factor in the case of chief importance. I refer to the influence of forests upon the amount of moisture in the atmosphere, as seen in the amount of rainfall. It is fully believed by those who have given the subject the most study, that the extent and distribution of the forest determines to a great degree the amount and regularity of the rainfall. Certain it is that all observations bearing on the subject, taken in countries which were formerly, to a considerable extent, covered with forest, and have been denuded, and then after a term of years allowed to grow up again, tend to prove this. Those who are able to compare the present condition of our streams, large and small, with what they were fifty years ago, all concur that they have been largely affected by the removal of forests. This has become so apparent that several states have already taken legislative action, aud I am glad our state is among the first to ascertain all the facts attainable on this subject. If thus, by devoting a sufficient proportion of land to forest, we can obviate, to a large extent, the rapid rise and fall of streams and the

long continued droughts which all dread, then we gain far more in the increased productiveness of the rest than the use of these poorer portions are worth.

Then from my standpoint, I would observe first of all, do not try to fence in and reclaim every thing, but make a judicious selection and let those portions which cannot be used profitably for tillage or grazing go back to forest, and devote our energies to the rest.

I have found that as farmers we must not, in this progressive age, cling too closely to our preconceived ideas. We all have our theories, our pet notions, and sometimes by constant urging we make hobbies of them. Just how we came in possession of these ideas we cannot always tell. Sometimes they appear to be a portion of the paternal inheritance, at other times we consider them the logical sequence of a very clever train of syllogistic reasoning, and lay them down with all confidence in the results. But after all, it is seldom that these theories stand the actual test of careful experiment, but oftener the results prove to be entirely contradictory to what was expected. We are somewhat nonplussed at this, but rather than own up that we might have been wrong in our premises or reasoning, seek for the cause everywhere, in the elements, in the weather, and even in the *moon*, save in ourselves. There is a satisfaction in having our pet ideas affirmed, but whether we reason from cause to effect, or from effect to cause, we must ever remember that it is the finite competing with the infinite, and that although we may discover and learn much to our profit, we cannot *change* nature's laws. We must take things as we find them, and when we find that the conditions of successful farming change, as they have done in so marked a manner during the past thirty years, he who wishes to succeed will change his methods accordingly. It is not enough to know what was for the best a generation ago. Much of the soil requires different handling, and more depends on a thorough tillage than when the land was new. Here in Vermont, at least, we must do something more than tickle th earth with the hoe that she may laugh with a harvest. Markets have changed, transportation is much more easy and rapid ; competition has increased, and the products of all sections and countries are brought in contact, so that quality is now of even greater importance than ever before. If there was a time when it paid the farmer to sell poor stock, poor butter or a poor article of any kind, that time it past. We must be ready to change our methods whenever it is for the best, and be able to give some better reason for our manner of work than because our fathers and grandfathers did it so and so. No doubt they did for the best under the circumstances, but it is a reflection on their judgment and sagacity to suppose they would follow the same routine under varying conditions.

Experience has impressed me more and more with the importance of a thorough, practical education for the farmer. Not a mere smattering of generalities, having no definite aim or object in view, but a knowledge of his surroundings and of those things he intends to practice. A technical education adapted to his own business, corresponding in its nature to that by which the professional man, the mechanic or the tradesman fits himself for his particular calling. The time is past,

even if it ever did exist, when the dullard of the family can hope to make a successful farmer. Brains are as necessary to success in farming as in anything else, and sometimes I think more than the average amount is required. It is only well directed effort that pays, and he who relies on muscle alone will be pushed to the wall. Life is too short and time too valuable for any one to experiment for himself over the whole field, and as we are all co-workers in a common cause, we need not hesitate to avail ourselves of the results of others' investigations who have been over the same ground, wherever they may be found, whether in book, paper or by the wayside. Having this vantage ground, we should try and work on a little farther than those who went on before.

Failures are often more instructive than successes, and I have found my failures are caused by want of proper knowledge oftener than otherwise. Some one has said that the difference between a wise man and a fool was that the fool would make the same blunder twice which the wise man would never do. The farmer of to-day cannot afford to make the same mistake twice, and if from want of proper knowledge he does founder on some unknown rock, it will ever afterwards serve as a warning and incentive to better directed labor.

It may seem like a broad statement to make, but I do not believe there is a single acre of tillable land in the state of Vermont that could not be made to pay a profit on all labor and capital applied, if we only had sufficient knowledge of the facts and conditions pertaining to that soil and the ability to make a proper application of them. That such may be the result is certainly no more improbable than any of the recent scientific discoveries. There is always a way to solve the problems of nature, and though some of them may seem intricate and mysterious, I believe that patient investigation will in time unfold them all. So I would throw legend and superstition aside, and through study and patient inquiring only, look for the key to unlock earth's choicest treasures. Agricultural operations should have back of them all some good reasons which appeal to the intelligence rather than to the credulity of man.

It is not usually safe to venture all in one specialty. There are instances in which it would be advisable for the farmer to devote all his resources and energies to some particular crop. These comparatively rare cases are determined by the location and surrounding circumstances and the adaptation of the soil and *man* to the plan contemplated, and are usually the outgrowth of some small experimental beginning. The owner of the average hill farm, who hastily concludes that he is one of these exceptional cases, takes a great risk, and will be very apt to have reason to regret his course. He should aim to supply his own necessities, as far as practicable, from the farm, and for the surplus raise that which will bring the most for the least expense and not impoverish the farm. Observation will show that, as a rule, those have succeeded best who have substantially followed this course.

It will not pay to invest very largely in commercial manures. While I would not advise any farmer to reject their use without trial, their indiscriminate use will rarely prove profitable. I hold them to

be a decided acquisition to our agricultural resources, and they have come to stay, for their judicious use will, in many instances, prove profitable, as they have in the past. Still it is a question of serious doubt if the hundreds of thousands of dollars annually paid by the farmers of Vermont for chemical manures is returned to them in the increase of crops produced by their use. The waste of manure is one of the greatest leaks in the most of farms. The want of proper facilities in saving it, and the proper care in using such facilities as we have, often making half difference in what is received and what might have been. It is an easy matter to thus lose more than the value of a ton of phosphate. As barn manure is more nearly a perfect fertilizer, economy and experience would both suggest that we save all we have and then supplement by buying only that which our land needs, and buy it in the most economical form.

We cannot be too fully impressed that the proper preparation of the soil for crops is one of the most important steps, and on our hill farms it is the hardest, but it must be well done, or it is of little use to expect a good crop. Thorough tillage will almost take the place of manure, while any amount of manure will hardly make up for the lack of proper cultivation. Land worked too wet so that the soil remains in hard lnmps through which the air cannot permeate, will never produce even a tolerable crop, for the roots of plants never penetrate where the air cannot. The same soil finely pulverized and properly worked, will at another time produce an excellent crop, showing that it matters not how much plant-food the soil contains if it is locked up so as not to be available.

One of the principal drawbacks to thorough tillage on our hills is, the presence of so many stones. Picking up and removing them has never been regarded as particularly pleasant pastime by any one, and the average boy is supposed to have a peculiar antipathy for this kind of work. Nevertheless, experience has shown me that it will not pay to work over many loose stones. If it is thought there are so many that the expense of removing them will be so large that it will not pay, then let that piece of land alone. For if once attempted, the extra time and muscle spent in working it, extra wear and tear of tools, and the loss from a diminished crop will cost more than to remove the stones at first. With our short seasons it is a point of importance to be ready to commence work as soon as possible in the spring. Have the ground ready to plow, and if as well for the crop would plow in the fall, for the delay of a few days in putting in the crop when the soil is in the right condition will often make half the difference in the harvest. It is well to bear in mind the old adage, "whatever is worth doing at all is worth doing well." Do not plan more work than can be properly attended to. Our ambition to spread over a large area sometimes leads us too far. The fields which we see so many times here and there on which the crop is not one-half, often not one-fourth of what it should be, save in the English sense of "half crop and half weeds," are forcible illustrations of the folly of such a course. The stereotyped excuse is "want of time," but in all such cases the same or less labor bestowed on one-half the ground would produce more bushels, and the land be left in much better con-

dition for succeeding crops. Such fields are only an aggravation, and are always a source of loss to the owner.

The proper selection of stock cannot be over-estimated. This matter alone is of sufficient importance to the farmer to make all the difference between success and failure. A good animal of its kind, whether it be horse, cow, sheep, hog, or even hen will always pay for raising and keeping, but the loss on a poor one will offset the profit on one or two good ones. This distinction is more marked than it used to be, for competition and co-operative association have raised the standard so that the demand for inferior or indifferent stock is even less than ever before. It is not enough that the farmer make a judicious selection of stock of its kind; he must select for the locality and purpose designed. Large and heavy animals that might do well on level or moderately rolling bottom lands, would be but illy adapted to our steep and rugged hills. If the production of milk, of cheese, of butter is the prime object, selection must be made accordingly, and so on through the list of farm animals. Having selected the animals the next point is how can we feed to the most profit? It is not slways that the largest product yields the largest net profit. We readily learn that we lose by not feeding enough, and we can lose by feeding too much. To me the most desirable standard of feeding is the one that will maintain the animals in the best health and vigor, and bring the largest net income.

The early maturity of animals intended for the production of meat must be always kept in view. Feeding too long or keeping unproductive animals are too often a source of waste on the farm. The farmer must have a surplus to sell to meet the demands upon him, and when to sell is often a perplexing question. A generation ago the farmer had but to watch his local market, but now the markets of the world must be taken into account. As a rule, much greater losses are incurred by holding too long than by selling too soon. The greater risk is usually on the holder's side, and I have in mind now several farmers heavily in debt or insolvent, who might now have been free of debt had they sold at the proper time. But I must not multiply details. The farmer to be successful must be contented with his calling, and determined to make the most of the advantages he already possesses. The superior inducements of other localities and other callings are often found, when reduced to actual test, to be but the enchantment of distance. The farmer cannot regard his work like that of a day laborer. He cannot receive his pay as soon as it is earned, and if he continually works with the aim of getting his pay in the quickest possible time, he, too often, does it at the expense of his land. Much of his work is for the future as well as the present, for he must keep the condition of his farm in view as much as his immediate returns. To pursue any course by which his land depreciates in value is just as unwise as for the merchant to increase his cash account at the expense of his capital stock. Still, I have known many farmers who have accumulated money, and were supposed to be doing well, when, if the depreciation of their land and buildings were taken into account the balance sheet would be against them. That such a policy *cannot* be commended requires no argument, for if

the fertility of our farms continually decreases it is only a question of time when they must be abandoned. If on the other hand they continue to improve, the future becomes easier than the past in a continually accelerating ratio. If by any means our hill-farms can be made to pay, the future success of farming here in New England is assured. For if these are profitable to work, those more favorably located will be still more desirable.

I am not sanguine enough to regard the future of Vermont farming as beyond doubt and risk. The time is past, here or elsewhere, when we can expect favorable results without thorough preparation and watchful care. But I believe the outlook is as promising now as it ever was, and compares favorably with many much higher praised localities and with other pursuits. With proper selection and study of their needs all the available portions of our hills may continue to furnish peaceful, independent homes in the future as they have in the past, and I believe the time is very far distant when they will be given over to the "howling wilderness."

MILK.

By Hon. E. R. Pember, Member of Board.

Milk, in its natural, healthy state, is the most complete article of food known. It is the only single kind of food that can in itself supply all the needs of the human system. Fruits, vegetables, meats and the cereals all have their place among the great staples of human food, but each of them is incomplete in itself and will, if used exclusively for any great length of time, fail to produce the highest state of health and vigor. That man should not live by bread alone is a fact as old as human history. But milk lacks none of the essential nutritive elements, and will build up every bone and tissue in the whole structure, being capable of sustaining man in the full perfection of his physical powers from the hour of his birth to the hour of his death. It comes to us in perfect condition to use. There is no labor, no cost in preparing for food. No waste as in all other animal or vegetable substances which man appropriates to his use. No refuse of bone, but an abundance of bone forming material. It is truly a wonderful substance which, without any further preparation, contains, properly combined, all the elements of growth and nutrition needed in the human economy. Let us learn something of its composition.

ANALYSIS OF MILK.

The chemist finds that it contains, on the average, about eighty-seven per cent of water and twelve to fourteen per cent of dry matter, which latter is made up of fat, casine, milk sugar and a little mineral matter, about three-fourths of one per cent. This small percentage of mineral matter represents all that is necessary to build up or repair the framework of the person or animal to whom it is fed. About two-thirds of this mineral matter or ash, says Wanklyn in his standard work on the analysis of milk, is phosphate of lime and the other third principally chlorides. There is hardly any alkali, free or carbonated, in the ash of cow's milk. The degree of freedom from alkali is so perfect that the ash does not neutralize as much standard acid as it would if $\frac{1}{100}$ of its weight consisted of alkaline carbonate. From an extensive series of analyses made by Dr. Voelcker, the distinguished chemist of the Royal Agricultural Society of England, he gives the following general conclusions: Milk of average quality contains about

two and one-half per cent. pure fat and eleven per cent. dry matter, and yields about ten per cent. of cream. Milk which contains more than ninety per cent. of water and less than two per cent. of pure fat is naturally *very poor* or has been adulterated. When milk contains twelve and one-half per cent. of solids and three and one-half per cent. of pure fatty matter, it is considered rich, and if it contains more than four per cent of pure fat it is of extra rich quality.

THE FATTY MATTER OF MILK.

Of the several milk solids this is the most variable. While the proportions of casine, milk sugar and ash are quite constant, seldom varying more than three-fourths of one per cent., the amount of butter or pure fat is subject to great variation, some samples of milk being four times as rich in this element as others, and in occasional instances showing a greater difference than this.

Dr. Voelcker gives the following table, as showing the greatest variation in cows milk not produced in any way adnormally:

	1.	2.	3.	4.
Water	83.90	85.20	87.40	89.95
Butter	7.62	4.96	3.43	1.99
Casein	3.31	3.66	3.12	2.94
Milk sugar	4.46	5.05	5.12	4.48
Mineral matter	.71	1.13	.93	.64
	100.00	100.00	100.00	100·00
Percentage of dry matter	16.10	14.80	12.60	10.05

No. 3 represents the amount of butter contained in milk of average good quality, such as is ordinarily produced by native, Ayrshire or Holstein cows. Milk from good Jersey cows will contain as large an amount of butter as is shown in No. 2, while any milk richer than this will be found only in exceptional cases. A cow owned in Palmyra, N. Y., was found, on trial, two or three years since, to make one pound of butter from eight and one-half pounds of milk.

Dr. Voelcker also gives the following tables, showing the difference in the composition of the milk of different animals as compared with woman's milk:

	Woman.	Cow.	Goat.	Ewe.	Ass.	Dog,
Water	88.94	87.03	85.54	76.70	91.65	83.10
Butter	2.67	3.13	4.08	1.20	.11	4.45
Casein	3.92	4.87	4.52	13.37	1.82	5.76
Milk sugar	4.33	4.37	} 5.86	7.10	6.08	5.73
Mineral matter	.14	.60		1.63	.34	.96
	100.00	100.00	100.00	100.00	100.00	100.00

The space of time intervening between milkings indicates, to a certain extent, the amount of fat contained in the milk. The following

is given as an average result of experiments on this point. Milk from the same cow taken after an interval of

10 hours contained	4.36	per cent. of fat.
12 " "	3.97	" "
14 " "	3.51	" "

The difference between the larger and the smaller amount of fat being replaced by almost precisely the same amount of water. This result is in accordance with the opinion usually entertained among observing dairymen that the morning's milk is richer than the evening's milk, as the interval between milkings is usually less at morning than at night. When the cow is fed regularly and subjected to no disturbing influences, the secretion of milk, in common with all the other functions of animal economy, goes on regularly and uniformly during the twenty-four hours of the day and night. About twelve hours is probably as long as the milk can be carried in the udder without sustaining some loss, either in quantity or quality, or both. In many instances cows giving a large flow of milk have been milked three times a day to advantage. This method of milking has usually been practiced, I believe, with those cows which have the largest record for quantity of milk.

UNIFORMITY IN THE COMPOSITION OF MILK.

Analyses made by Professor Alexander Muller of Sweden with the mixed milk of fifteen cows, which were highly fed and tended with regularity, gave the following average result, the analyses extending throughout the whole year:

Water	87.19
Fat	4.05
Casein	3.32
Milk Sugar	4.71
Mineral matter	.73
	100.00

This table shows the usual proportions found in good milk and is chiefly valuable in showing the small fluctuations in the composition of the milk, which during the entire period were very small. In but four instances did the water fall below eighty-six and six-tenths, and in but four did it rise above eighty-eight. This shows that the composition of the milk of the same cows, if uniformly well fed, varies but little throughout the year, whatever the changes in temperature, seasons, etc., may be. This, however, would not hold true if the cows were subjected to exposure in all sorts of weather and their feed allowed to vary largely in quality. For it is a fact now established beyond doubt, that the composition or quality of milk, no less than the quantity, depends to a very considerable extent upon the nature of food with which the cow is provided. The cow has no power to create. The subtle power of the alchemist is not hers' and she cannot, by any natural laws, transmute poor and refuse material into golden butter. It is just as reasonable to expect the manufacturer

to make fine broadcloth out of coarse shoddy, as to suppose any cow can produce a large quantity of rich milk if kept on poor or insufficient food. Man's natural avariciousness may lead him to foster the hope that he may sometime produce bricks without straw, but the laws of nature will always prevent its consummation.

ANALYSIS OF MILK IN THE UNITED STATES.

The analyses of milk to which I have referred are, as will be observed, the results of experiments in Europe. They differ but slightly, however, in their general character from analyses made in this country, no more so than we might expect, as the conditions and surrounding circumstances always vary somewhat so that no two analyses will ever be exactly alike.

The late X. A. Willard gives the following as the composition of average American milk, also of skimmed milk, cream, butter and cheese:

	New Milk.	Skimmed Milk.	Cream.	Butter.	Cheese.
Water	87.50	90.64	59.25	13.67	30.81
Fat	4.00	.58	35.00	85.00	32.41
Casein	3.25	3.37	2.20	.51	25.87
Milk sugar	4.50	4.63	3.05	.70	5.07
Mineral matter	.75	.78	.50	.12	5.90
	100.00	100.00	100.00	100.00	100.00

It is a fact which has been noticed by observing dairymen, that some fields which have long been pastured by milch cows have become deficient in the phosphates. These tables show the reason why this is so and suggest the remedy. A cow in producing five thousand pounds of milk must remove from the soil about thirty-seven pounds of mineral matter, mostly phosphate of lime. It is easy to see how this drain, if extended over a long term of years, would result in a depletion of the soil in this essential element of all plant growth. While butter contains but a trace of mineral matter, cheese retains nearly all of it, thus showing that if the milk or cheese is sold from the farm, nearly all the phosphate of lime which the milk contains goes with it, but if the milk is made into butter, and the skim milk fed to animals upon the farm, much of the phosphate is returned to the land in some form if the manure be carefully saved and applied.

VERMONT MILK.

Prof. Collier while at the University at Burlington analyzed ten samples of Vermont milk with the following average result:

	Collier.	Sabin.
Water	87.19	86.32
Fat	4.05	4.38
Casein	3.32	3.82
Milk sugar	4.71	4.67
Mineral matter	.73	.76

In February, 1883, Professor Sabin, at Burlington, analyzed some of the mixed milk of ninety cows, with the result noted in the second column. These tables are sufficient to show the composition of milk under both ordinary and varying conditions. While it will be always noticed there is a wide difference in the milk of different cows kept under the same conditions, the milk of the same cows varies but slightly when kept uniformly well.

MILK IN ITS STRUCTURE.

As is well known, milk is a glandular secretion peculiar to the mammalia. The fat which it contains not being soluble, it is essentially an emulsion of fatty particles held in an aqueous solution of caseine, milk sugar and small quantities of mineral matter, forming an opaque liquid of a whitish color. It is heavier than water, having an average specific gravity according to Voelckes of 1.030, and according to Wanklyn of 1.029, taking distilled water as the standard at 1.000. According to Scherer, the specific gravity fluctuates between 1.018 and 1.045. The richer the milk the less the specific gravity, as the cream is lighter than the milk, and consequently must affect its weight in proportion to the amount it contains. European authorities agree that cream is slightly denser than water, and consequently will sink in distilled water. According to their experiments the specific gravity of cream varies from 1.005 to 1.024. Dr. Sturtevant gives as the result of some of his experiments in cream showing a specific gravity 983, and also found cream that would sink in water. It is probably safe to assume then that cream will generally be found slightly denser than pure water. The water which enters into the composition of milk and which forms, as we have seen about eighty-seven per cent. of it may be extracted by evaporation, leaving the milk solids, which we will briefly consider separately.

THE FAT.

The fat of milk, unlike the other solids, does not exist in the milk in a state of solution, but occurs in the form of minute particles or globes, termed globules, which are held in suspension in the surrounding aqueous solution. This is the most important feature in the structure of milk and one of special importance to the dairyman, as it is this peculiarity of structure which determines the whole process of raising the cream and obtaining the butter. These globules give the rich color to the milk and also, as previously alluded to, affect its weight. They vary much in size in the milk of the different breeds of cows, and when viewed under the microscope are found to range from $\frac{1}{2000}$ to $\frac{1}{4000}$ of an inch in diameter, some being larger and some be-

ing infinitely small. These globules are pure butter, and are a mixture of several fats, consisting of palmitin, stearine, oleine, and small quantities of odoriferous oils, namely—butyrine, caprine, caproine and capryline. According to Voelckes, palmitin, which is a solid, crystallizable substance, with a little stearine, constitutes about sixty-eight per cent. of butter. Oleine, a liquid, fatty matty, about thirty per cent., the remaining two per cent. being made up of the odoriferous oils before mentioned in varying proportions. This fat is hard at winter temperature, but fuses at a very low temperature, the heat of summer many times being sufficient for this purpose.

THE CASEINE.

Caseine forms the nitrogenous constituent of milk. Strictly speaking, it is composed of at least two distinct chemical substances, but for convenience under the term caseine we designate the entire nitrogenous or albuminous constituents of milk, just as under the name gluten the entire nitrogenous portion of flour is comprehended. Like albumen, caseine exists in two modifications, soluble and insoluble. It exists in the former state in new milk and in the latter in milk that has changed or soured. Milk is coagulated and the caseine rendered insoluble by rennet, acid, and some metallic salts. Caseine constitutes one of the principal elements of cheese, and consequently milk containing it in the largest proportion, and in which the fat is the most firmly held, is the best adapted for this purpose. The difficulty, often experienced in cheese making, in retaining all the fatty matter arises from the fact that it is only held mechanically, for rennet does not coagulate cream, or more strictly speaking the fat of milk.

MILK SUGAR OR LACTINE.

This may be obtained from milk by coagulating the caseine and removing that along with the fat and then evaporating the liquid or whey to crystallization. Milk sugar differs from cane sugar in that its specific gravity is less, its sweetening power is less, and dissolves in water far less readily. The ash or mineral matter of milk I have already alluded to sufficiently.

THE BUTTER GLOBULE.

I wish to make special mention of some facts showing the close and certain relation between the structure of the milk, as occasioned by the butter globule, and the breed of cows. Also the effect produced by the globules, when occurring in different sizes and varying in quantities in the keeping qualities of milk, in raising cream and making butter.

Dr. E. L. Sturtevant, one of our best authorities on this matter, gives as the result of his investigations and experiments with the milk of different breeds of cows the following conclusions:

That the butter globules of the milk show a certain and definite relation botween the quality of the milk and the breed. That the breed determines to a large extent the composition of the butter, and

also determines largely whether it is most economical to manufacture into butter or cheese. Some of the characteristics of milk peculiar to the different breeds may be thus indicated. The globule of Jersey milk is larger than the globule of other breeds, and there are fewer under a certain size. The globule of Ayrshire milk is smaller than that of Jersey milk, and varies much in size, some being quite large and many extremely small. The globules of Holstein milk are the smallest of the three, but are more uniform in size.

We shall find in practice that the size of these globules will determine many things for us and a knowledge of their workings under varying conditions will aid us materially in handling milk.

The first thing we notice is, that when set for cream the milk having the largest globule sends up its cream quickest, and the separation is most complete on account of their less specific gravity. The smaller globules are the last to rise, and in milk containing a large proportion of them very small a part may be retained with the caseine of the milk and never rise. We shall find that milk which sends up its cream most rapidly usually furnishes the greater per cent. of it, and is richer in butter. This shows that milk containing large globules, while it is desirable for butter making on account of the ease and facility with which it separates its cream, is the least desirable for transportation to market, or for making into cheese. It is for this reason that Jersey milk is more profitable to work into butter than cheese, and is the most ill adapted of all milk to bear transportation to market.

For cheese making we want milk that is rich in caseine rather than fat, and that does not part so readily with its butter globules, so there is less danger of their passing off in the whey. Milk of this kind can be kept in good condition a long time, and sent to market a long distance with comparative safety. Every practical butter maker has observed the difference in samples of skimmed milk. Some will be white and thick, and some blue and watery. When coagulated and the whey separated, the difference in the structure will be plainly apparent by the contrast in the amount of whey produced, and an equally apparent contrast in the amount of caseine or curd contained in each. As we have seen that milk with uniformly large globules sends up its cream in less time, we find also that this cream will make butter with less churning than cream which is composed of smaller globules. It is evident that this should be so, for the agitation of the cream by the churning process causes these globules to separate themselves from the surrounding fluids and to adhere or coalesce together, thus gradually forming themselves into little lumps or pellets of butter until they reach a size sufficiently large to be seen when we say "the butter has come." Now the larger the globules are to start with, the less agitation or churning is required to bring them together in this granular form, for by the law of attraction the larger the particles the more readily they come together.

MIXING MILK OF DIFFERENT BREEDS FOR BUTTER.

The question arises in this connection, do we get the best obtainable results in butter when the milk used contains globules of very

uneven size. Theoretically we would not. For instance, if we should mix Jersey milk, having large globules, with Holstein milk, having a small globule, the larger ones would separate and form granules of butter first, and this part be over churned while waiting for the smaller globules to complete their separation, which they would do imperfectly, and some of them would finally pass off in the buttermilk and be lost. This seems a very reasonable inference, and I think is worthy of careful consideration, but as yet the results of experiments upon this point have not all been one way, so that the question still remains partly theory rather than established fact. So far as I have been able to learn, experiments upon this point have shown that there is, many times, a loss in mixing milk which differs considerably in its structure, and I expect the investigations of the next few years will determine this matter beyond dispute.

OTHER CAUSES AFFECTING THE SIZE OF THE GLOBULE.

We find also that the globule usually varies in size in the milk of the same cow, according to the length of time from calving, gradually diminishing in size as the time increases. This gives us the reason why the cream from farrow cows and cows long in milk requires more churning, and sometimes, when it has not been properly handled or the temperature is not quite right, refuses to come at all. So that after expending a great deal of power and hazarding the risk of putting the nervous and moral forces at severe tension, it is given up in disgust. In contrast with this, we notice that the milk from cows recently in milk separates its cream more readily and completely than later on, and the skim milk is correspondingly poorer, and the cream requires but little churning to form into butter, thus showing the presence of large globules, which corresponds with the results of microscopic examination.

IS THE BUTTER GLOBULE ENCLOSED IN A CASE OR SHELL?

The theory formerly advocated by writers upon this topic was that the butter globule was enclosed in a case or sack of casein, and that in order to produce the desired separation in churning these shell-like surroundings must be broken down by the application of force, and claimed that when this was done they might, by the aid of the microscope, be seen floating about in the buttermilk like hulls of wheat chaff on a threshing floor. To carry out this theory, the churns used were constructed with a view to apply as much force as possible to the cream, having inside gear of various kinds. I have in mind one churn in which this application of force to the butter globule was carried to the extreme point of grinding the cream in a manner similar to that in which painters grind their paint, supposing that by this means the surrounding sacs of the globules would be so crushed that it only required a little further agitation to bring the liberated globules together in mass. With all due deference to the eminent authorities upon dairy topics who have advanced this theory, I have as yet seen no good reason for accepting it. My observation has led me to believe that the butter globule has no investing membrane, and that if

by any means it is subjected to conditions by which its globular structure is broken down, the product is seriously injured for table use. We all know that this can be done by heat, the warmth of summer many times being sufficient for this purpose. We should remember, also, that the application of force will do this just as effectually as heat, and instead of the firm, wavy texture we so much admire in butter we have only a soft oily mass. As I have before mentioned, the separation of the globules in churning is the result of agitation by which they are brought in contact with each other, and when the temperature is right they will unite at once. This process of cohesive attraction begins at once when churning is commenced, but owing to the exceeding minuteness of the globules, union is slow at first and cannot be seen by the naked eye until quite far advanced. But once commenced, the union is accelerated like the rolling snow ball, until the granules of butter are plainly visible.

FIRST DRAWN MILK COMPARED WITH LAST DRAWN.

The first drawn milk differs from the last drawn, or strippings, in that the first drawn contains a much larger per cent. of water and the last drawn is correspondingly rich in butter. From an analysis made of the milk of eight different cows, as given in the London Lancet a few years ago, it was shown that the proportion of cream in the first drawn was to the last drawn as 61 to 141. Dairymen generally understand that the last part of the milking is much the richest in butter, and when cheese factories were first established in this state, occasionally a patron who was a little more avaricious than honest would keep back a portion of the last drawn milk from each cow, as it was much more valuable for butter than for cheese. As a needed protection it became necessary to enact laws to prevent the practice of this peculiar species of fraud.

MILK INFLUENCED BY FEED.

As previously alluded to, the relative proportions of the constituent elements of milk are largely influenced by the feed which the cow receives. The man who is aiming simply to produce a large quantity of milk will need to feed quite differently from the man who is trying to produce the richest quality. Very succulent food, like roots, will increase the flow of milk without any corresponding increase in the amount of butter contained in that milk. This brings in the question of scientific feeding, and however pertinent it may be in this connection, cannot be discussed further than to say that it is a subject of fully as much importance to the dairyman producing milk, butter and cheese as to the man growing fattening animals for the shambles. If the feed given the cow is deficient in any essential element, that deficiency is at once found in the milk. If the grass or hay on which the cow feeds is deficient in phosphate, the milk will fail to furnish a complete food for the young and growing animal, and the cow makes her want known by gnawing all the old bones she may chance to find.

QUANTITY OF MILK THE COW IS CAPABLE OF PRODUCING.

In her natural state the cow is incapable of yielding more milk than is necessary to sustain her calf during the first few months of its existence, until it is able to graze about and obtain its own living. By domestication and the skill of the breeder through many generations the lacteal secretion has become so thoroughly developed that all the powers of the cow's organism have become auxilliary and subservient to it, and the amount of milk produced is sometimes wonderful. The average cow, to make 150 pounds of butter or its equivalent in cheese, must yield about 3,500 pounds of milk, and the cow that will each year yield 5,000 pounds of milk is above the average and one that any dairyman will be slow to part with. These estimates, of course, refer to cows of average size, fed well enough to keep in good health and vigor, but not forced in any way, and allowed to grow dry two or three months in the year. There are many instances recorded of amounts far greater than these. In all of these test cases the cows were kept in milk during the whole year, and were usually fed as high as their powers of digestion and assimilation would bear. Among these noted yields I may mention Jersey Queen, of Barnet, which gave 12,854 pounds of milk in one year, from which was made 851 pounds of butter. At least two Holstein cows have given each over 18,000 pounds of milk in a year and many others over 16,000 pounds. One heifer at two years old gave 13,574 pounds, and dropped her second calf two days less than a year from her first. Several of these last mentioned cows gave an amount of milk equal to their own live weight in twenty-two consecutive days. These accounts seem almost incredible, and show to what a degree the milk producing organs may be stimulated. Large as these amounts seem it is as reasonable to suppose the possible cow of the future will *outstrip* them all as that improvement will mark human effort in any other direction.

INFLUENCE OF IMPROPER FOOD ON MILK.

We all understand that good, healthy, rich milk can only be produced from food containing these properties, so we should likewise remember that the converse of this proposition holds equally true, and a cow fed on mouldy hay and rotten vegetables, or compelled to drink stagnant water, will surely have her milk contaminated by so doing. Milk, which has been in any way thus contaminated, either by food or water, or by absorption from impure surrounding, is always diseased and unhealthy. Our medical journals have recorded a large number of facts bearing on these points, showing conclusively that impure milk is an agent in diffusing disease to an extent far wider than the people generally suppose. Many cases are cited where children, and even whole families, have been prostrated by disease, and the cause has been traced directly to the use of milk from cows which were either out of health or were kept in tight or ill-ventilated stables, and fed on swill or some feed in the incipient stages of putrefaction. That the milk was the cause of the disease was proven by the fact that the disease entirely disappeared when the persons afflicted stopped using the milk. And when the disease was of a peculiar type, only

those families and persons were afflicted who used the milk from a certain source. There is no need that I specify any of these cases by locality, or describe any in detail. Every physician of long practice has had more or less similar cases under his observation. There is more danger of milk becoming contaminated by bad water than from dry feed in a bad condition. Numerous cases have been given in which the germs of fever were supposed to have been communicated through the milk, by allowing the cows to slake their thirst from pools of impure water, or water that has previously been polluted by drainage. This has been somewhat doubted by others, but that the typhoid fever contagion has been retained in and communicated through the milk either in this way, or by using vessels for the milk, particularly wooden ones, which have been carelessly and imperfectly cleaned, seems to be beyond question. This subject of communicating disease through milk is one, which has not until recently claimed very much attention, and of course is not as fully understood in all its causes and effects as it will be, but enough is already known to establish as facts, beyond reasonable doubt, the cases I have already cited and to show us that milk is many times the prolific source of diseases now obscure, and unless careful inquiry is made into the condition and surroundings from which we receive our supply, and dairymen will consider how far these facts will apply to cases coming under their observation and experience, we shall neglect a sanitary measure of great importance.

HOW BRUTAL TREATMENT OF COWS AFFECTS THE MILK.

Farmers, for the most part, are incredulous concerning the changes liable to be produced in milk in consequence of brutal treatment of the cows, or anything causing intense nervous excitement. If a farmer does maltreat his cows, he may be willing to admit, when his passion has become sobered, that such treatment will diminish the quantity of milk. But when he is asked to believe that the milk, from this cause, is rendered less nutritious and has also become somewhat changed from its normal condition, and is on this account not so healthful as an article of food, he will be apt to regard the idea as preposterous. Yet, I have no doubt, that such is the case. If there was any doubt on this point the evidence given by Dr. Crothers of Albany, and many others, would be amply sufficient to disprove it. As proof analogous to this may be cited the many cases of chorea, convulsions and epilepsy of infants, so well known among the medical fraternity, which were caused by nursing while the mother was laboring under some violent excitement. Anything which deranges the nervous system always affects the lacteal secretion unfavorably. This is general law and holds true not only in the human race, but through all the mammalia. The moral of all this then is plain. Furnish proper food and drink, and use only gentle treatment.

THE IMPORTANCE OF MORE KNOWLEDGE.

We cannot expect men to change their practices or to adopt new customs until convinced of their errors, and the necessity for a

change, and I am pleased to see that medical science has already given us so much light on this subject, and bids fair to solve satisfactorily any point which may yet be involved in obscurity. In no way can information be disseminated of more value to all, for all use milk, than by presenting in an irrefutable manner all the causes affecting the healthfulness of milk. This is of primary importance, for I hold that the first and highest duty of the medical profession is to disseminate correct information in regard to the laws of health, the ounce of prevention, in this case particularly, being better than the pound of cure.

EXPOSURE OF MILK TO BAD ODORS.

After the milk has been produced in a pure and healthy condition, it is necessary that the same degree of care and discretion be exercised in its handling as previously. Milk is extremely susceptible to odors, far more so than water, and when exposed in any way to foul odors of any kind, will absorb enough in a short time to not only become apparent to the senses, but to produce a deleterions effect upon it as an article of diet. One of the most penetrating of odors is tobacco smoke, and if it comes in contact with milk will surely be retained. The odors from tight, ill-ventilated stables will be taken up whlle milking, and the milk is said to have a "barn taste." A term the meaning of which the milkmen know full well, and which requires ceaseless care and vigilance in regard to all the details of cleanliness to prevent. It is necessary, then, after getting pure milk that it be kept in only pure air, and particularly is this essential if it is to be made into butter. For whatever exposure affects the quality or purity of the milk will affect the butter made from that milk, even in a more marked degree. Several instances of this kind have come under my own observation where persons of excellent reputation as butter makers, and who had uniformly received first prices, suddenly found their butter failed to give satisfaction, and the price largely reduced. The buyer may not be able from the butter alone to tell just what the trouble is, but he knows something is wrong, and the price is lowered accordingly. I need not, then, in view of all these well known facts, urge any further the importance of pure milk. It is not only a question of health but one of pecuniary consideration also, and where these two great incentives of life and action are found, as they are in this case, to both lie in the same direction, is any further argument needed to strengthen their force, or impress upon us the importance of a strict compliance with known laws.

WEATHER PROBABILITIES;

OR

Popular Weather Prognostics.

By Dr. Hiram A. Cutting.

Attempts have been made in all ages to foretell coming storms, and many nations have had weather prophets of more or less note; some of which have depended upon observations and thought, while others have been simple impostors, hazarding guesses and making popularity, if they had any, upon the old saw, "I told you so," after any peculiar change, or notable storm, had passed, and as they were always telling—something, their "I told you so" would gain credit with some, and often a wide spread popularity would result. Such popularity was usually of short duration; yet some were deified as gods; some called doctors, and others prophets. At the present day, such probabilities have been reduced to a science, and handled by telegraph as news of good or bad import, and thus, the coming storm is telegraphed hours and sometimes days in advance. The United States government have established, in connection with the War and Post Office Department, a Signal Service, so-called, that telegraph to every section of our country the approach of storms, and if our state government would provide, by a series of stations, for the distribution of this knowledge, it might become of the greatest value to every citizen of our state, and of especial value to the farmer, as the value of an entire crop is often dependent upon proper harvesting, and the actual knowledge of coming storms would often save thousands of dollars to a single township. This information could doubtless be best distributed by signals from steam whistles, or strokes of a bell, and also aided by flags of different colors, carried on the engines of our railroad trains, and, perhaps, displayed from some hills, mountains or high buildings. That those signals, as well as the bulletins of the war department, now distributed and published in most of our daily papers, be understood, it will be necessary to review somewhat the character of our storms, and the methods used to aid our knowledge of the probabilities telegraphed. The signal service office at Washington contains maps, or daily synoptic charts, showing the atmospheric pressure, temperature, wind, rain and general climatology of North America each hour. As the knowledge is imparted from the observers by telegraph, the changes to correspond are made, and thus the progress of the storm is before the eyes of the men that prepare the bulletins for the people. It is not guess work, but actual knowledge of the condition of the atmosphere in all sections of the country, that enable them to predict from the known past the probable future. So expert have they become in judgment, from the knowledge of the paths of the storms, that they are enabled to speak with a certainty

almost absolute, of their future course. A glance at their charts, or even at the daily maps published, shows that there is nearly always present either an area of low pressure, called a cyclone, usually having a circular form, and as a rule moving in a definite and well known direction, and with a regular, and perhaps constant velocity; or else there is an area of high pressure,—nearly circular like the former, but almost stationary, called an anti-cyclone. The wind in all cases blows in a direction nearly parallel with the isobars having the region of lowest barometer on the left hand. This has given rise to the simple rule or law of storms for this hemisphere, viz.: "Stand with your back to the wind and the barometer will be lower on your left than at your right." In cyclones the wind circulates in the opposite way to which the hands of a watch move, with a slight indraught; while in anti-cyclones the wind circulates in the same way as the hands of a watch, but with a little outward motion. Nearly all of our weather is of the cyclonic or anti-cyclonic type, and is dependent upon the form and distribution of the isobars. It is by the aid of such charts, and the known direction of the wind and the barometer, hygrometer, and popular signs by practiced observers, that we are enabled to foretell the weather.

CYCLONE PROGNOSTICS.

We will first take a well formed cyclone. In the accompanying diagram, Plate XVIII, the broad features of the relation of cloud and rain to a cyclone center are shown, the full line indicating the path of the depression, and the dotted line at right angles to it is the trough, or lowest barometer.

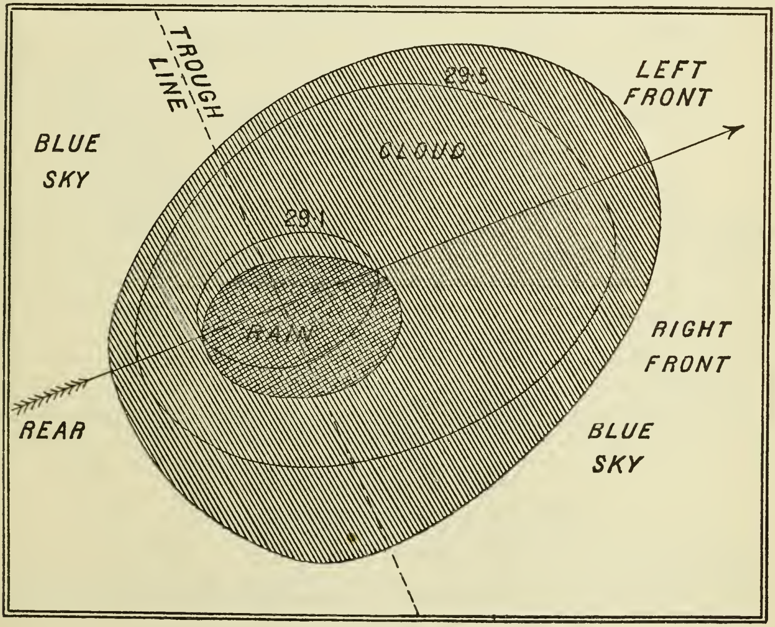


Plate XVIII.

As explained by the signal service notes, we find in the extreme front of the depression there is a blue sky, then, as the barometer begins to fall, and sometimes even before that takes place, a bank of cirro-stratus, preceded by a halo-bearing sky, makes its appearance, which gradually becomes lower and denser, and forms an overcast, dirty sky. In the whole front of the depression the temperature rises, and the atmosphere feels muggy and close. In the right hand front the clouds assume the cumulo-stratus type, with driving rain later on. In the left-hand front the air is cooler, but still oppressive, with an easterly wind and overcast sky, succeeded by drizzling rain or ill-defined showers. When the trough of depression has passed, the barometer begins to rise, the wind changes and becomes squally, with showers of rain; the air grows cooler, and the clouds break and ultimately clear away.

Now, with regard to the prognostics with reference to Plate XIX, where the characteristic weather in the different portions of a depression are given in a diagrammatic form, it will be seen that the first indication of a coming change is the appearance of a halo round the sun or moon in the cirro-stratus clouds.

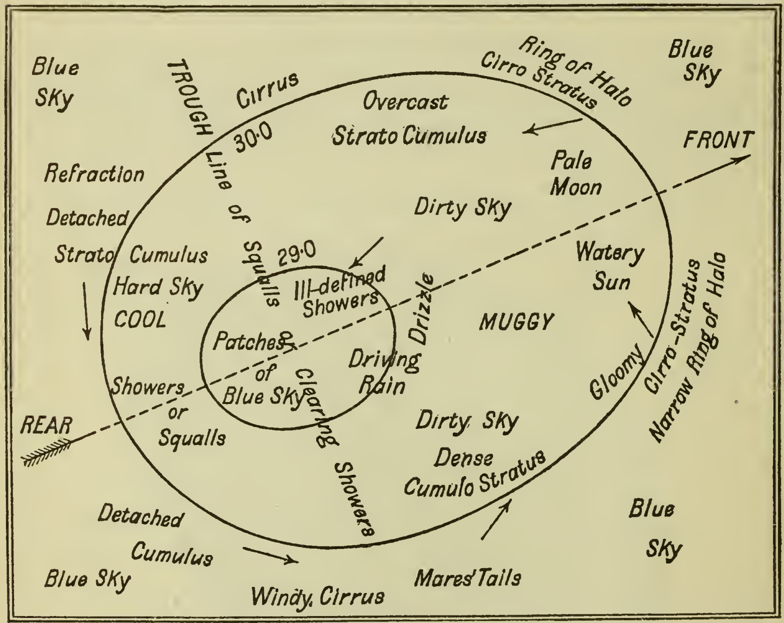


Plate XIX.

HENCE HALO INDICATIONS.

When round the moon there is a brugh,
The weather will be cold and rough.

The moon with a circle brings water in her beak.

Halos predict a storm (rain and wind or snow and wind) at no great distance, and the open side of the halo tells the quarter from which it may be expected.

Mock suns predict a more or less certain change of weather.

With regard to the open side of the halo indicating the quarter from which the storm may be expected, it does not appear that this can be much used as a prognostic. It, however, most probably originated in the fact that halos are often seen in the south-west or west, when the sun or moon is rather low, the lower portion of the halo being cut off by clouds banking up in that direction, and that our storms generally come from those quarters. Yet by others it is supposed to be the direction from whence the wind is blowing. Be it as it may, a halo is a very good prognostic. During the last twenty-eight years at Lunenburgh, I have observed three hundred thirty-six solar halos and one hundred forty-one lunar halos.

Of the solar halos, rain or snow fell in twenty-four hours or less in two hundred seven cases; in thirty-six hours or between twenty-four and thirty-six hours in sixty-six cases; between thirty-six and seventy-two hours in twenty-four cases; leaving twenty-nine cases of failure, or twenty-nine cases where rain did not fall until another depression.

Of lunar halos, eighty-seven were followed by storm within twenty-four hours: twenty-nine in less than thirty-six hours; nine in less than seventy-two hours; leaving sixteen cases where there was no storm until the next depression.

Abercromby says that in one hundred fifty-five solar halos in London, one hundred twenty-nine were followed by storm in that depression and the remainder were not; of lunar halos he observed sixty-one, fifty-three of which were followed by storm and eight were abortive.

THE SUN AND MOON.

After halos comes the pale, watery sun or moon.

Abercromby says:

"When the sun appears of a light, pale color, or goes down in a bank of clouds, it indicates the approach or continuance of bad weather."

If the sun goes pale to bed,
'Twill rain to-morrow, it is said.

A red sun has water in his eye.

When the moon has a white look or when her outline is not very clear, rain or snow is looked for.

From the extreme damp in this part of the depression, while the sky generally is pretty clear, clouds form round and "cap" the tops of mountains and hills, a circumstance that has given rise to numerous local sayings: That when Mount Washington, Camel's Hump, Equinox, Mansfield, or any other hill or mountain is capped in clouds it will storm, and those that live near the mountains also hear a strange, hollow, roaring sound, which is the murmer of the forest, disturbed by wind, which adds its weight as a prognostic, and storm follows nine times out of ten, when both are combined.

DAMPNESS.

From excessive damp the following signs may be explained, and become valuable:

When the walls are more than usually damp, rain is expected.

Doors and windows are hard to shut in damp weather.

The sailor notes the tightening of the cordage on his ship as a sign of coming rain.

A lump of hemp acts as a good hygrometer, and prognosticates rain when it is damp.

As the depression approaches and the atmosphere becomes gloomy, close, and muggy, some people are troubled with rheumatic pains and neuralgia, old wounds, and corns are painful, animals and birds are restless, and drains and ditches give out an offensive smell:

When rheumatic people complain of more than ordinary pains in the joints, it will rain.

If corns, wounds, and sores itch or ache more than usual, rain is to fall shortly.

A coming storm your shooting corns presage,
And aches will throb, your hollow tooth will rage.

When animals seek sheltered places instead of spreading over their usual range, an unfavorable change is probable.

If cattle turn up their nostrils and sniff the air, or if they lick their fore feet, it is a sign of rain.

If toads come out of their holes in great numbers, rain will soon fall.

If glow-worms shine much, it will rain.

When gnats bite keenly, and when flies keep near the ground, we look for wind and rain.

When spider-webs are seen floating about in the air, farmers regard it as a sign of coming rain.

When spiders build their webs at an angle upon the grass, it is a sign of rain.

As the depression center approaches still nearer, rain sets in and continues till the barometer turns to rise. The passage of the trough is often associated with a squall or heavy shower, commonly known as "a clearing shower." Immediately the air becomes cooler and loses the former muggy sensation, and soon small patches of blue sky appear.

A small cloudless place in the north-east horizon is regarded both by seamen and landsmen as a certain percursor of fine weather or a clearing up.

The steady rain breaks up into showers or cold squalls, which are followed by hard detached cumulus or strato-cumulus till the sky becomes blue again:

When after a shower, the cirro-strati open up at the zenith, leaving broken or ragged edges pointing upwards, and settle down gloomily and compactly on the horizon, wind will follow, and will last for some time.

This is a description of a clearing up before the windy portion of a depression has passed.

In the south of the depression near the outskirts, windy cirrus and "mares' tails" are observed, which indicate wind rather than rain, as they are south of the rainy portion.

The cloud called goat's hair or the gray mares' tails forebodes wind.

If clouds look as if scratched by a hen
Get ready to reef your topsails then.

Mackerel sky and mares' tails,
Make lofty ships carry low sails.

The shift of the wind is different in the right-hand portion of the depression to what it is in the left-hand portion. In the former, on its first approach, the wind backs to the south and falls very light to an almost ominous calm. The first puffs of wind give rise to a noise in tree tops, and little eddies of dust, or to a whistling of the wind

indoors, which are well-known signs of rain. Then, as the depression passes along, the wind gradually veers to south-west and west, with increasing strength. Hence,

> When the wind veers against the sun,
> Trust it not, for back 'twill run.

In the left-hand side of the depression the wind will back round from south through east to north and northwest. In the rear of the depression on the left-hand side the wind blows from the northeast and then north, when the clouds begin to break and the weather to clear. When the depression has nearly passed away the wind in the rear draws round to the northwest, and gradually abates, and the weather becomes fine. Hence the saying:

> Do business with men when the wind is in the northwest.

This bringing the finest weather is said to improve men's tempers, as opposed to the neuralgic and rheumatic sensations felt in front of a depression.

OUR WEATHER.

Though this describes a large bulk of our weather there are showers, or series of showers, that can be foretold by understanding that there may be wedged shape isobars and straight isobars, the latter much the more common and represented by Plate xx.

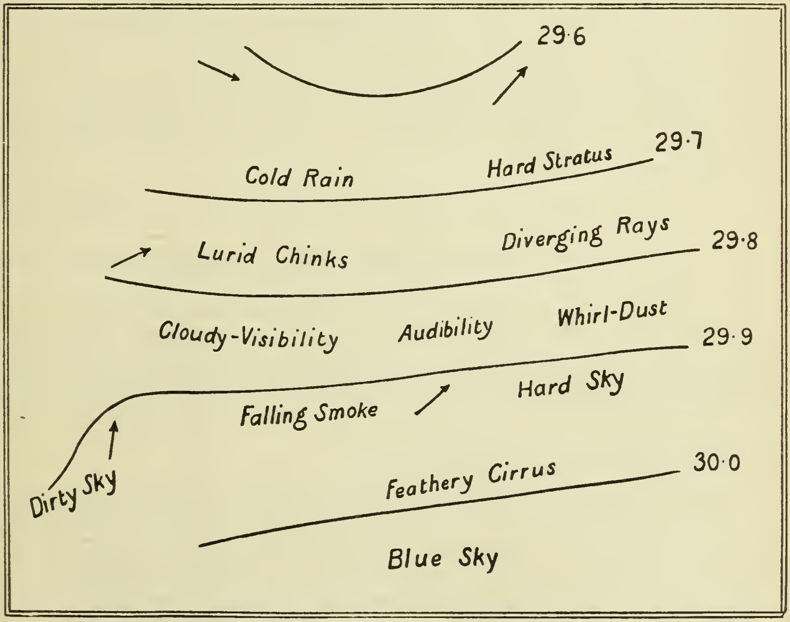


Plate XX.

ISOBAR PROGNOSTICS.

Now we come to the consideration of some very interesting rain prognostics associated with straight isobars. While those in a de-

pression are preceded by an almost ominous calm, and a dirty, murky sky, these are associated with a hard sky and blustery wind, of which it would be ordinarily remarked " that the wind keeps down the rain," or " that when the wind falls it will rain." While also the prognostics which precede cyclone rain hold good for the reason that they are seen in front of the rainy portion, those associated with straight isobars hold good because, though there is little rain actually with them, the area which they cover to-day will probably be covered by a depression to-morrow—the conditions being favorable for the passage of depressions. On looking at Plate xx, it will be seen that while the pressure is high to the south, it is low to the north, without any definite cyclonic system, and that the isobars run straight nearly east and west.

Near the high pressure the sky is blue, then as we approach the low pressure feathery cirrus, or some form of windy sky, makes its appearance, while a blustery wind whirls the dust, or blows the soot down ; and animals turn their backs to the wind to avoid its force on their faces.

When chimneys smoke and soot falls, bad weather is at hand.
When sheep, cattle, or horses turn their backs to the wind, it is a sign of rain.

Getting still nearer the low pressure, the sky is found to be gathering into hard stratus, at first with chinks between its masses, through which divergent rays stream down under the sun, which is spoken of, as " the sun drawing water." Sometimes, especially in winter, these rays are lurid. At the same time there is often great " visibility " with a hard overcast sky, and moderately dry air, in which the stratus seems to play the part of a sunshade, for as soon as the sun comes out the clearness diminishes. Simultaneously we often find " audibility."

If the noise of a steamer or railway train is heard at a great distance, rain is predicted.

This distinctness of distant sounds must be carefully distinguished from sounds which are not usually heard, being brought up by the wind coming from a rainy quarter. For instance, the whistle of a railway train to the south of a house will not be usually heard with the normal southwest wind of this country ; but when the wind backs in front of a depression to the south, then it will be heard, and although this will be a good prognostic, still it is not true audibility.

A good hearing day is a sign of wet.
Much sound in the air is a sign of rain.

This last exactly conveys the kind of sound referred to. The reason why audibility is produced is unknown, but the old idea that it is due to excessive moisture in the air is certainly erroneous ; in several instances, we have observed that the upper current of the wind appeared to be moving much faster than the lower, and perhaps that may have something to do with it.

Though as a matter of convenience we have described the sequence of weather as we proceed from high to the low pressure, it must be clearly understood that it does not represent the sequence of weather

to a single observer, but rather what the weather will be simultaneously in different parts of the country.

ANTI-CYCLONE PROGNOSTICS.

Having spoken of cyclones, we shall now direct our attention to anti-cyclones. In the daily weather charts we sometimes see but two or three isobars, and these are a considerable distance apart, and extend over a large area. The pressure is highest in the centre, and gradually diminishes outwards. The air is calm and cold in the central area, but on the outskirts the wind blows in the direction of the hands of a watch. These are the special features of an anti-cyclone. The weather in an anti-cyclone is almost the opposite of that in a depression; that in the latter being wet and unsettled, while that in the former is usually settled and fine, with more or less haze in the air. Another great difference is that while depressions are generally rapid in their movements, anti-cyclones are nearly stationary; and it is for this reason that they are associated with "settled" fine weather. In the area of high pressure the characteristic features are largely modified by what is termed "radiation" weather, as determined by diurnal and seasonal variations; and as the pressure is nearly stationary, these diurnal and seasonal variations are the chief features of anti-cyclonic weather.

We shall now give the prognostics due to the variations in some detail. See Plate XXI.

The sky being generally clear and the air calm, the temperature is high in the day and low at night. In summer brilliant sunshine prevails during the day, and at night there is a heavy dew, and in low-lying places mist.

Heavy dews in hot weather indicate a continuance of fair weather, and no dew after a hot day foretells rain.

If mist rises in low ground and soon vanish, expect fair weather.

Thin, white, fleecy, broken mists, slowly ascending the sides of a mountain whose top is uncovered, predicts a fair day.

When the mist creeps up the hill,
Fisher out and try your skill.

When in the morning the dew is heavy and remains long on the grass, when the fog in the valleys is slowly dissipated and lingers on the hill-side, when the clouds seem to be taking a higher place, and when a few loose cirro-strati float gently along, serene weather may confidently be expected for the geater part of that day.

These all refer to night radiation, mist being dispersed by the sun's rays. Fine, light, genial weather raises the spirits and exerts an enlivening influence not only on human beings but also on animals, birds, insects, etc. Hence the saying.

If larks fly high and sing long, expect fine weather.

When owls whoop much at high, expect fair weather.

Bats, coming out of their holes quickly after sunset and sporting in the open air indicates fair and calm weather.

The wind in an anti-cyclonic system blows in the direction of motion of the hands of a watch, but slightly outwards, and as the anti-

cyclone is nearly always stationary, the wind blows from the same quarter for several days together.

The wind is usually very light in force.

It is said to be a sign of continued good weather when the wind so changes during the day as to follow the sun.

If wind follows sun's course, expect fair weather.

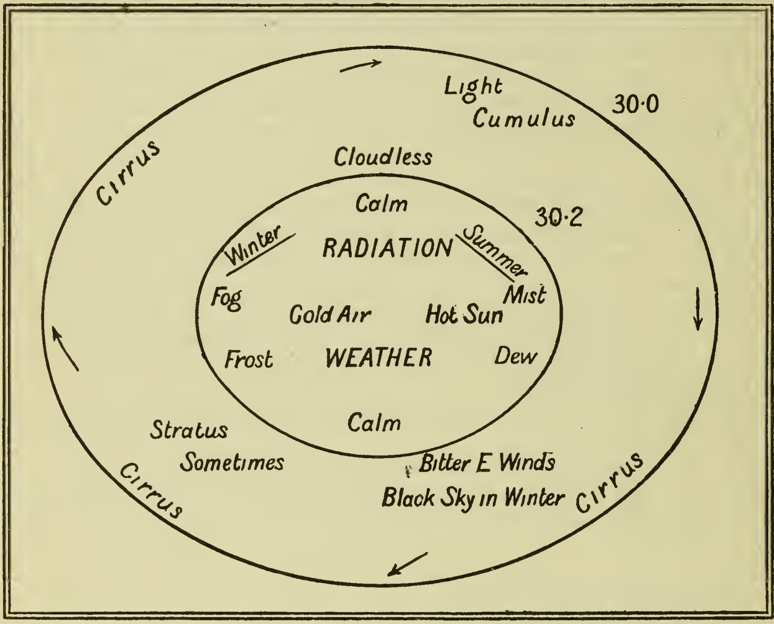


Plate XXI.

This "veering with the sun," as it is called, is the ordinary diurnal variation of the wind, which in this country is very obvious with the shallow gradients of an anti-cyclone. At sea-side places in summer very often "the wind is in by day and out by night," which is the equivalent of the land and sea breezes of the tropics. Like two preceding prognostics, it is only in anti-cyclones that local currents of air, probably due to unequal heating of sea and land, can override the general circulation of the atmosphere in this country.

On the northeast side of the anti-cyclone in summer, light, cumulus clouds frequently form in the morning, gradually increase till after the maximum temperature has passed, and then decrease and disappear towards evening.

If woolen fleeces spread the heavenly way,
Be sure no rain disturbs the summer day.

When the cumulus clouds are smaller at sunset than they were at noon, expect fair weather.

Clouds small and round like a dapple gray with a north wind, fair weather for two or three days.


MIDDLE PACIFIC
REGION
ATLANTIC
STATES
LLEY
ER
LAKES
MIDDLE ATLANTIC
STATES
NEW ENGLAND
STATES

DISTRICT MAP.

The cirrus cloud is usually seen on the outskirts of an anti-cyclone, if in the front it gradually disappears, but if in the rear it is a sign that there will be a change in the weather, hence:

If cirrus clouds dissolve and appear to vanish, it is an indication of fine weather.

If cirrus clouds form in fine weather with a falling barometer, it is almost sure to rain.

When, after a clear frost, long streaks of cirrus are seen with their ends bending towards each other as they recede from the zenith, and when they point to the northeast, a rain with southwest wind may be expected.

Both these latter prognostics refer to a depression coming in and "breaking up the weather" and the anti-cyclone.

It will be seen from the foregoing information that has been brought out by Abercromby and others, and verified by our signal service, that storms apparently so irregular are quite regular in fact, and that they are not only traced in their course scientifically, but have various signs of their passage, that are prominent even to the casual observer, I would now refer you to the map—where the districts are marked off with red ink, as they are refered to in all the prognostications of the signal service. It is well to study this until it is fully fixed in your mind, and then the course of storms as spoken of or foretold will become definite, and you will at once comprehend the course they are moving through, and you can thus understand why their probabilities are so regular and certain in their fufillment. It is not a guess, it is a conclusion from positive knowledge. Mountains, forests and valleys modify the general storm. That this modification may be made apparent, I give you observations made at Lunenburgh, 1,210 feet above sea level, and top of Mt. Washington 6,279 feet above and twenty-five miles distant. That the comparison may be under the eye at the same time, I combine both in one table. There is a sure diminution of rain fall at this place, and an equally sure increase about wooded mountains. This change is as marked as the change in the forest line, and many a farm suffers from drouth in consequence. Please observe July, 1884, in the table, where the difference is 21.40 inches in that month. Many other months are also very marked; but while such mountains receive more water from the clouds than formerly, the average rainfall for the first twenty-nine years of observation at Lunenburgh was 41.19 inches annually, but for thirty-six years the diminution reduces the average to 40.21 inches, while the average for the last six years is but 36.02 inches. This decrease is in our summer rains as it will be seen the snow fall is as great as ever.

COMPARATIVE PRECIPITATION.

By months in inches and hundredths.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual rainfall.
1872..Mt. Washington.......	1.67	.30	.89	.07	4.69	18.46	3.59	6.41	9.56	5.53	4.01	1.38	56.56
1872..Lunenburgh...........	2.00	3.05	2.70	2.00	8.20	7.33	7.25	12.79	3.48	2.37	5.05	5.00	61.22
1873..Mt. Washington.......	3.39	5.20	5.81	2.72	4.55	3.26	13.54	5.81	13.66	9.23	5.50	5.95	78.62
1873..Lunenburgh...........	3.85	3.35	4.50	2.65	2.64	2.00	3.95	2.50	4.75	5.45	2.22	2.65	40.51
1874..Mt. Washington.......	4.40	2.47	6.71	5.74	6.53	13.44	7.94	9.51	5.52	2.96	2.34	3.07	70.59
1874..Lunenburgh...........	3.70	1.80	2.25	4.05	2.95	7.06	4.98	4.38	1.35	1.15	2.71	3.17	39.55
1875..Mt. Washington.......	1.82	1.00	2.13	2.00	2.50	6.83	7.40	7.95	11.34	6.30	2.67	3.84	55.78
1875..Lunenburgh...........	3.60	4.02	3.00	2.85	3.73	5.70	2.55	3.40	4.35	5.26	2.92	1.40	42.78
1876..Mt. Washington.......	2.80	3.50	6.30	3.12	7.83	9.32	14.51	2.20	14.89	3.21	3.49	6.48	77.65
1876..Lunenburgh...........	3.55	3.60	3.05	3.70	4.70	7.05	5.22	1.25	5.90	1.60	1.67	2.81	44·10
1877..Mt. Washington.......	2.06	.33	11.64	3.40	3.72	8.78	11.27	11.11	2.79	7.75	17.55	6.01	86.41
1877..Lunenburgh...........	2.15	.65	6.40	2.35	1.05	3.00	4.22	5.95	2.05	4.70	2.65	1.87	38.04
1878..Mt. Washington.......	8.54	5.88	10.66	23.41	9.28	7.67	11.00	11.35	7.36	5.78	4.78	8.77	114.48
1878..Lunenburgh...........	1.65	.80	2.25	6.15	2.45	4.65	3.35	4.45	1.20	2.60	2.70	2.30	34.55
1879..Mt. Washington.......	7.13	7.01	7.51	6.71	4.40	11.84	10.23	9.55	6.33	5.03	9.53	5.56	90.83
1879..Lunenburgh...........	3.45	2.75	3.15	2.70	1.45	5.80	5.00	4.67	3.78	2.20	4.18	4.30	43.43
1880..Mt. Washington.......	4.24	2.56	4.87	3.47	5.51	5.86	7.24	5.82	15.23	7.96	9.37	7.80	79.93
1880..Lunenburgh...........	2.25	2.60	1.47	1.40	3.05	2.30	2.45	3.79	2.40	4.70	2.18	2.55	31.14
1881..Mt. Washington.......	3.94	6.62	8.51	5.08	12.50	7.03	9.93	11.96	6.13	18.38	15.10	15.95	121.13
1881..Lunenburgh...........	2.90	1.70	2.60	1.00	4.55	2.20	3.09	2.75	2.45	4.85	5.19	4.92	38.20
1882..Mi. Washington.......	7.20	5.94	14.52	11.20	8.91	11.40	10.03	2.81	13.32	6.19	3.25	2.64	97.41
1882..Lunenburgh...........	3.75	3.75	1.75	1.55	2.20	4.93	2.85	1.05	5.26	1.45	1.27	2.40	32.21
1883..Mt. Washington.......	4.16	5.65	4.18	6.29	9.10	11.30	11.14	6.06	6.90	5.55	3.72	2.66	76.71
1883..Lunenburgh....... ...	2.10	3.65	2.40	1.30	4.00	4.34	4.80	1.18	2.90	4.50	2.83	2.60	36.60
1884..Mt. Washington.......	1.69	7.55	4.16	3.29	9.54	8.08	23.90		For se	ven mo	nths.		58.21
1884..Lunenburgh...........	3.30	2.30	4.60	1.26	4.45	1.95	2.50		"	"	"		20.36

The other meteorological table shows the average temperature and amount of rainfall, including the melted snow for thirty-seven years, observations by myself at Lunenburgh. The mean is made from three daily observations during the times stated, either by myself or one employed for the purpose. (For Meteorological Table, see next page.)

While we have spoken of the signs belonging to depressions and certain special conditions of our atmosphere, and of our general precipitation, there are many things that may be observed belonging to conditions of the atmosphere likely to produce rain, whether that is caused by a cyclone, or any other cause. Many of these are truly of value while many others are whims and utter foolishness. Our ancestors believed in witchcraft and many now have a lingering belief in the moon controlling the weather, according to its age ; and that certain days may control months, and that there are peculiar signs in bad Fridays, and Saturdays. It is needless to say, even to children, that Mondays or Tuesdays, or any other days, might be as well considered unlucky or to control weather, but as the moon aids in tides of the ocean, and must also aid in atmospheric tides, there seems to be some reason on the side of the moon's influence. Many have in consequence kept careful record of the moon's changes and storms. For thirty-seven years I have never been able to detect any influence of the moon over the weather, or over growing crops either. Leonard Hill of East Bridgewater, Mass., carefully observed the same for sixty-three years, and he says " there is no observable influence of the moon upon the weather." Mr. Merriam of Cambridge, Mass., made close and accurate observations upon the weather for thirty years, and he declares that in all his experience he never was able to perceive that the moon had the least influence upon our weather. He says " multitudes however believe in this rank heresy ;" they run to the almanac when the moon is new, when it quarters, or is full, and predict a change of weather at these points. The fact is these arbitrary periods, occurring once a week the year round, amount to nothing. We have a moon all the time, and in our climate the weather is subject to constant change, sometimes it changes every day, sometimes not for weeks together, but how foolish if the change of weather comes, as it will on an average one time in seven, near the periods set in our almanacs for moon changes, to say the moon is the author of the change.

Some people always say, this is a wet moon, and the other a dry one, not thinking that God has fixed the course of the moon as well as of the earth, and that its course, apparant like that of the sun, is different every day of the year, and yet the new moon runs highest in June, and lowest in December, but is it any more wet or dry at those times? then the sun changes its apparant course continually ; is our weather changed also? So much for this fallacy.

On the other hand there are signs of the coming storm shown by atmospheric phenomenon, peculiar actions of insects, animals, etc., having scientific facts for their cause, which in connection with what the signal service tell us, will materially aid in our correct judgment. These I classify and arrange for your consideration. They are all of some value ; yet not all equally so. They are from all sources as well as from observation, and yet do not by far exhaust the subject.

METEOROLOGICAL TABLE.

Latitude, 44 deg. 28 min. Lon 71 deg. 41 min. Elevation, 1210 feet.

Year.	Average monthly Temperature in degrees and hundredths.												Yearly Means.	Rain & melted Snow.	Winters.	Snow in inches.
	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.				
1848	19.50	17.00	30.40	41.30	50.00	67.65	70.30	69.25	58.50	44.50	26.00	20.40	42.90	41.00	-1848	71.00
1849	10.70	14.50	30.90	40.50	53.70	58.90	69.60	54.75	56.40	40.90	30.40	19.50	39.99	35.80	1849–50	84.00
1850	10.00	14.07	25.50	35.00	55 00	69.50	67 60	64.00	58.30	50.00	29.73	21.00	41.64	40.00	1850–51	52.00
1851	20.50	14.22	31.75	39.16	57.00	62.50	64 25	70.00	51.50	40.00	25.80	19.00	41.31	33.50	1851–52	48.00
1852	20.50	19.28	21.00	32.00	50.50	64.50	69.00	65.50	58.00	43.00	30.00	21.00	41.19	39.00	1852–53	86.00
1853	22.00	12.70	23.50	38.00	54 00	63.50	69.75	67 00	56.50	43 50	28 70	23.75	41.91	41.75	1853–54	100.00
1854	10.50	9.00	22.34	34.16	52.30	67.10	70.40	64.50	57.25	45.75	32.30	15.25	40.07	36.60	1854–55	70.00
1855	21.70	14.30	29.20	39.60	40 80	63.70	67.20	68.25	60.00	43.75	30.00	21.00	41.63	38.25	1855–56	83.00
1856	22.00	18.50	20.40	35.50	51.30	67.40	68.50	64.00	57.70	44.00	28.90	20.00	41.51	39.80	1856–57	79.00
1857	14.20	20.00	24 50	32.70	50.60	65.30	60.80	62.30	52.00	42.50	31.00	19.50	39.02	37.25	1857–58	69.00
1858	8.30	23.10	24.70	34.60	50.00	59.15	65.30	62.40	53.00	42.50	33.40	21.50	39.83	38.50	1858–59	78.00
1859	17.75	19.00	25.50	33.00	51.50	63.00	64.50	67.00	57.00	39.50	34 00	14.00	40.48	35.30	1859–60	58.00
1860	18.20	16.00	28.50	38.00	58.50	66 50	69.00	66.00	55.50	49.00	39.00	19.00	43.60	38.90	1860–61	99.00
1861	19.50	22.00	27.00	41.50	48.50	63.25	68.00	66.00	54.00	45.00	32.00	21.00	42.31	47.00	1861–62	147.00
1862	16.00	19.50	26.50	39.00	55.00	63.00	68.00	62.00	59.50	48.00	30.00	20.00	42.21	45.80	1862–63	101.00
1863	24.00	19.00	19.20	36.10	59.20	64.30	70.20	70.00	56.00	47.00	26.70	18.40	42.51	46.00	1863–64	51.00
1864	18.00	20.60	31.00	41.00	55.00	68.20	71.90	70.90	55.88	48.10	33.86	22.56	44.75	39.02	1864–65	87.00
1865	14.80	19.06	33.80	40.97	49.21	67.30	60.84	70 82	56.55	37.42	34.56	24.46	42.48	39.69	1865–66	41.00
1866	14 45	20.35	27 50	37.98	45.10	69.00	73.25	60.90	52.37	48.68	45.72	20.91	43.02	38 10	1866–67	73.00
1867	9.62	23.52	24.61	39.10	49.34	65.97	70.06	64.83	49.37	44.93	30.05	10.90	40.19	39.65	1867–68	68.00
1868	11.69	8.87	28.45	34.61	53.04	63.65	72.07	67.26	54 98	41.49	29.55	14.86	40.04	43.37	1868–69	114.00
1869	19.27	20.00	19.67	38.80	51.91	61.78	68 19	63.83	62.07	43.30	30.53	22.03	41.78	4..95	1869–70	100.00
1870	22.08	16.31	23.89	43.31	54.08	69.12	72.57	67.63	60.42	46 69	33.71	22.15	44.33	45.65	1870–71	55.00
1871	13.74	17.42	34.45	42.00	53.99	64 92	68.18	66.86	55.21	47.75	26.69	17.27	42.37	42.96	1871–72	95.00
1872	14.62	16.31	16.72	38.74	54.88	66.95	70.43	69 66	59.77	45.48	31.80	9.09	41.20	60.91	1872–73	167.50
1873	12.69	15.20	24.31	38.69	51.85	62.17	69.66	65.48	57.00	47.10	23.37	19.97	40.62	40.51	1873–74	117.00
1874	20.26	17.40	24.84	31.08	51.50	64.17	70.45	63.75	58.61	46.42	27.68	15.26	40.95	39.45	1874–75	127.00
1875	5.96	9.79	21.77	33.47	52.06	61.43	64.96	66.73	51.96	41.22	24.05	18.44	37.66	42.84	1875–76	102.50
1876	19.39	16.17	25.95	37.04	50.18	65.57	68.15	65.48	55.22	40.28	34.33	12.00	40.69	43.15	1876–77	70 00
1877	9.78	24.10	27.70	42.40	52.48	63.99	68.96	66.84	58.71	43.83	36.86	24.36	43.33	38.04	1877–78	32.25
1878	15.02	20.83	32.41	46.70	52.10	61.88	68 46	65.70	58.82	48.72	32.20	21.19	43.67	34.55	1878–79	103.00
1879	13 08	13.00	25.84	35.80	54.73	60.82	66.43	60.92	54.05	50.27	31.61	21.79	40.69	43.43	1879–80	71.75
1880	24.41	21.74	24.10	40.10	57 85	62.67	65.53	64.51	59.08	43 28	27.85	15.88	42.25	31.14	1880–81	191.00
1881	8.03	18.25	32.64	37.77	56.79	57.50	65.72	66.32	62.90	44.16	32.00	28.45	42.62	38.20	1881–82	117.50
1882	13.27	20.05	25.33	34.16	46.78	61.93	66.52	65.62	57.30	48.11	30.54	18.64	40.69	32.21	1882–83	113.00
1883	9.87	15.00	16.83	36.90	52.07	65.56	66.12	63.41	55.95	41.51	34.33	17.43	39.66	36.60	1883–84	116.00
1884	9.09	21.80	24.85	39.23	51.49	65.49	64.61	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means	15.55	17.48	25.85	37.83	52.27	64.30	67.44	65.56	56.59	44.65	31.08	19.22	41.54	40.21		88.25

WEATHER PRORERBS RELATING TO ANIMALS.

Dogs.

Expect rain when dogs eat grass.

Dogs refusing meat is an indication of rain.

Cats.

When cats sneeze it is a sign of rain.

When cats are washing themselves fair weather follows.

Cats with their tails up and hair apparantly electrified indicate approaching wind.

When cats scratch themselves, or scratch on a log or tree, it indicates approaching rain.

Cattle.

When a storm threatens, if cattle go under trees it will be a shower; if they continue to feed, it will probably be a continuous rain.

When cows fail their milk, expect stormy and cold weather.

When cattle bellow in the evening, expect storm that night.

Expect rain when cattle low and gaze at the sky.

Cattle are also said to foreshow rain when they lick themselves, or lie down in pasture early in the day.

Domestic animals stand with their heads from the coming storm.

Horses.

When horses and cattle stretch out their necks and sniff the air it will rain.

Horses as well as some other domestic animals, foretell the coming of rain by starting more than ordinary, and appearing in other respects restless and uneasy.

Animals making unusual noise, indicates change of weather.

Sheep.

If sheep ascend hills and scatter, expect clear weather.

Sheep bleat and seek shelter before storm.

PROVERBS RELATING TO BIRDS.

When birds cease to sing, rain and thunder will probably occur.

If birds in general pick their feathers, wash themselves, and fly to their nests, expect rain.

Birds singing during rain indicates fair weather.

Blackbirds' notes are very shrill in advance of rain.

When bluebirds twitter and sing they call to each other of rain.

Chickens are said to be very noisy just before rain and cocks to crow at unusual hours.

During rain, if fowls pay no attention to it, you may expect a continued rain; if they run to shelter, it won't last long.

When chimney swallows circle and call, they speak of rain.

If the crows make much noise and fly round and round, expect rain.

Cuckoos hallooing in low lands indicate rain; on high lands indicate fair weather.

Larks, when they sing long and fly high, forebode fine weather.

Owls hooting indicates rain.

If owls scream in foul weather, it will change to fair.

Long and loud singing of robins in the morning denotes rain.

Robins will perch on the topmost branches of trees and whistle when a storm is approaching.

When snow-birds gather in flocks and light on fences and hedges, expect storm.

When swallows in evenings fly high and chirp, fair weather follows; when low, rain follows.

Their skimming along the ground indicates rain, especially if they fly in circles.

PROVERBS RELATING TO CLOUDS.

Storm-presaging clouds.

An English meterologist, the Hon. F. A. R. Russell, who for many years has been a cloud observer, has recently given his conclusions as to the predictive value of the upper clouds, showing that close observations upon them are even more sure than changes in the barometer, and that the "bar or ribbed cirrus, though somewhat uncommon, is equal in value to a danger signal. He finds also that detached patches of cirrus, like little masses of wool or knotted feathers, in a clear sky and of unusual figure, moving at more than the average rate, precede disturbances of great magnitude."

From Aristotle's time the value of cloud signs in storm and rain prognostications have been recognized, but their interpretation has only become possible, since the movement of storm centres over wide areas has been systematically traced. The irregular motions of the high clouds, perhaps more than their form (presenting the appearance of having been divided and torn by uprising currents), indicate dangerous cyclones. If the equatorial air current in which cyclones are borne along is undisturbed by a cyclonic vortex, the clouds floating in its higher strata would sail on at a uniform rate. But if we suppose that a storm is moving in the great current, the ascending air in the storm's centre is ceaselessly invading the cloud stratum above. It is this uprushing air which divides the clouds. But as the interchange between the surface and upper air in the cyclone centre tends to retard the swift upper current which transports the cirriform clouds, the motion of these clouds, both over the storm centre and far out in front of it, must often be retarded. The very rapidly moving cirrus clouds which Mr. Russell says precedes great disturbances must precede them at great distances from their centres —a fact which enhances their predictive value and shows the importance of observing them systematically.

Anvil-shaped clouds are very likely to be followed by a gale of wind.

Soft-looking, delicate clouds foretell fine weather with weak, moderate. or light breezes. Hard edged, oily appearing clouds, wind. A dark, gloomy, blue sky indicates wind; a bright, blue sky, clear fine weather. Generally the softer the clouds the less wind. Small inky clouds foretell rain.

If an assemblage of small clouds spread out or become thicker and darker, expect rain.

If you see a cloud rise against the wind, when that cloud comes up to you the wind will blow the same way that the cloud came, and the same rule holds good of a clear place when all the sky is equally thick except one clear edge.

If clouds be bright,
'Twill clear to-night;
If clouds be dark,
'Twill rain, do you hark?

When cirro-cumuli appear in winter, expect warm and wet weather. When cirri threads are brushed back from a southerly direction, expect rain and wind.

When cirri merge into cerro-stratus, and when cumulus increase towards evening and become lower clouds, expect wet weather.

A curdly sky will not leave the earth long dry.

If you see clouds going cross wind, there is a storm in the air.

Clouds flying against the wind indicate unsettled weather.

Dusky or tarnish-silver colored clouds indicate hail.

When clouds, after a rain, disperse during the night, the weather will not remain clear.

If the sky becomes darker without much rain and divides into two layers of clouds, expect sudden gusts of wind.

Dark clouds in the west at sunrise indicate rain on that day.

Evening red and morning gray will set the traveler on his way. But evening gray and morning red will bring down rain upon his head.

If the woolly fleeces strew the heavenly way,
Be sure no rain disturb the summer day.

If clouds at the same height drive up with the wind, and gradually become thinner and descend, expect fine weather.

When a general clouddiness covers the sky and small, black fragments of clouds fly underneath, they indicate rain, and probably it will be lasting.

Clouds being soft, undefined, and feathery, will be fair. Generally, any deep, unusual hue of clouds indicate rain and wind, while the more quiet and moderate tints indicate fair weather.

Narrow, horizontal red clouds after sunset in the west indicate rain before thirty-six hours.

If clouds float at different heights and rates, but generally in opposite directions, expect heavy rains.

Clouds floating low enough to cast shadows on the ground or cap mountains are usually followed by rain.

When the clouds hang on the mountain side after a rain and the sun shines on the top of the mountain, the storm is over.

When clouds are gathered toward the sun at setting, with a rosy hue, they foretell rain.

If there be red clouds in the west at sunset it will be fair; if the clouds have a tint of purple it will be very fine, or if red bordered with black in the southeast.

Red clouds at sunrise indicate storm on the following day.

Fog in the morning indicates a fair day.

If the clouds be of different heights, the sky being grayish or dirty blue, with hardly any wind stirring, the wind, however, changing from west to south, or sometimes to southeast, without perceptibly increasing in force, expect storm.

When streamers point upward, the clouds are falling and rain is at hand. When streamers point downward, the clouds are ascending and drought is at hand.

Two currents of clouds indicate approaching rain, and in summer thunder.

Clouds without dew indicate rain.

PROVERBS RELATING TO DEW.

The absence of dew for three days indicates rain.

> If nights three dewless there be,
> 'Twill rain, you're sure to see.

If there is a heavy dew and it soon dries, expect fine weather; if it remains long on the grass, expect rain in twenty-four hours.

PROVERBS RELATING TO FISH.

When fish bite readily and swim near the surface, rain may be expected. Fish become inactive just before thunder showers, silent and won't bite.

> Fish bite the least
> With wind in the east.

When fish or pickerel lie with their heads the highest look out for rain; level, settled weather; when lowest, clearing weather.

When fish jump up after flies expect rain.

PROVERBS RELATING TO FROST.

Bearded or hoar frost usually follows for two or three mornings in succession, and is followed by rain. Sometimes in winter it will be followed by warm or foggy weather and no rain. The first day after the first frost is usually very clear.

Frost will probably occur when the temperature is forty degrees, and the wind northwest.

A high wind prevents frost.

PROVERBS RELATING TO INSECTS.

An open ant-hole indicates clear weather; a closed one an approaching storm.

Ants are very busy; gnats bite; crickets are lively; spiders come out of their nests, and flies gather in houses just before rain.

When bees remain in their hives or fly but a short distance, expect rain.

> When bees to distance wing their flight
> Days are warm and skies are bright;
> But when their flight ends near their home
> Stormy weather is sure to come.

When little black insects appear on the snow, expect a thaw.

If the cricket sing louder than usual, expect rain.

Fire flies in great numbers indicate fair weather.

Spiders' webs at angles on grass indicate rain; if flat fair weather. If the garden spiders break and destroy their webs and creep away, expect continued rain.

> When spiders' webs in air do fly
> The spell will soon be very dry.

Spiders in motion indicate rain.

Before rain:

> Glow-worms numerous, clear, and bright
> Illuminate the dewy hills at night.

If gnats, flies, etc., bite sharper than usual, expect rain.

PROVERBS RELATING TO THE MOON.

A dim or pale moon indicates rain, a red moon indicates wind.

When the moon appears very large at rising it indicates fair weather if yellowish. If red it indicates rain. A circle round the moon indicates storm, the smaller the nearer the storm.

PROVERBS RELATING TO PLANTS

If the African Marigold does not open its petals by 7 o'clock in the morning, it will rain or thunder that day. It also closes before a storm.

Trembling of the aspen or poplar leaf in calm weather indicates an approaching storm.

The flowers of the chickweed contract before rain.

The chickweed, at 9 o'clock in the morning, if the weather is clear, straightens its flowers, spreads its leaves, and keeps awake until noon. If, however, there is rain in prospect, the plant droops and its flowers do not open.

Clover leaves turned up so as to show a light under-side indicate approaching rain.

The dandelions close their blossoms before a storm; the sensitive plant its leaves. The leaves of the maple trees bear up so that the under side may be seen before a storm.

When the perfume of flowers is unusually perceptible, rain may be expected.

If the hog or Canada thistle closes for the night, expect fair weather; if it remains open, expect rain.

When mushrooms spring up during the night, expect rain.

PROVERBS RELATING TO RAIN.

Unusual clearness in the atmosphere, objects being seen very distinctly, indicates rain.

Evening red and morning gray
Are sure signs of a fine day.
Evening gray and morning red
Will bring rain upon your head.

Increasing atmospheric electricity oxidizes ammonia in the air and forms nitric acid, which affects milk, thus accounting for sourness of milk by thunder, and indicates rain.

If rain commences before daylight, it will hold up before 8 A. M.; if it begins about noon, it will continue through the afternoon; if it commences after 9 P. M., it will rain the next day; if it clears off in the night, it will rain the next day; if the wind is from the northwest or southwest, the storm will be short; if from the northeast, it will be a hard one; if from the northwest, a cold one, and from the southwest a warm one.

If it rains before seven,
It will clear before eleven.

If rain begins at early morning light,
'Twill end ere day at noon is bright.

Rain long foretold, long last;
Short notice, soon past.

PROVERBS RELATING TO RAINBOWS.

If the green be large and bright in the rainbow, it is a sign of rain. If red be the strongest color, there will be rain and wind together. After a long drought the rainbow is a sign of rain. After much wet weather it indicates fair weather. If it breaks up all at once, there will follow settled weather. If the bow be in the morning, rain will follow; if at noon, slight rain; if at night, fair weather. The appearance of two or three rainbows indicates fair weather for the present, but settled and heavy rains in a few days.

Rainbow in morning, shepherds take warning;
Rainbow at night, shepherds' delight.

PROVERBS RELATING TO REPTILES.

Frogs singing in the evening indicate fair weather for next day.

Frogs croak more noisily, and come abroad in the evening in large numbers, before rain.

The color of a frog changing from yellow to reddish indicates rain.

Tree-frogs crawl up to the branches of trees before a change of weather.

If, after some days of dry weather, fresh earth is seen which has been thrown up by worms, expect wet weather.

Snails moving on bushes or grass, are signs of rain.

When black snails cross your path,
Black clouds much moisture hath.

Snakes expose themselves on the approach of rain.

A leech placed in a jar of water will remain at the bottom until rain is approaching, when it will rise to the surface, and if thunder is to follow will frequently crawl out of the water.

Leeches kept in glass jars move more frequently just before rain.

PROVERBS RELATING TO STARS.

When the stars flicker in a dark background, rain or snow follows soon.

When the stars begin to huddle,
The earth will soon become a puddle.

When the sky is very full of stars, expect rain.

PROVERBS RELATING TO THE SUN.

Since the colors and duration of twilight, especially at evening, depend upon the amount of vapor which the atmosphere contains, these appearances should afford some indications of the weather which may be expected to succeed. The following are some of the rules which are relied upon by seamen: When after sunset the western sky is of a whitish-yellow, and this tint extends a great height, it is probable that it will rain during the night or next day. Gaudy or unusual hues, with hard definitely outlined clouds, foretell rain and probably wind. If the sun before setting appears diffuse and of a brilliant white, it foretells storm. If it sets in a sky slightly purple, the atmosphere near the zenith being of a bright blue, we may rely upon fine weather.

If the sun sets in dark, heavy clouds, expect rain next day.

Sun setting double indicates much rain. Red sun indicates fair weather. Orange sun usually foul weather. Mock suns in winter are usually followed by intense cold.

Rays of the sun appearing in a cloud forebode rain. This phenomenon is, in fact, caused by the image of the sun being reflected in an intervening cloud, the reflected image radiating in the cloud. This is

called sun's drawing water, and in the morn indicates rain; in the evening fair weather.

A halo around the sun indicates the approach of a storm, within three days.

When the sun rises with dim, murky clouds, with black beams, clouds in the west, or appears red or green, expect rain.

A pale, yellow sunset, a golden sunset, or a green sunset, indicates rain.

A bright yellow sunset indicates wind; a neutral gray is a favorable sign in the morning, and unfavorable in the evening.

The sun reveals the secrets of the sky.
And who dares give the source of light the lie.
(Virgil)

PROVERBS RELATING TO WIND.

If the wind backs against the sun,
Trust it not, for back it will run.

A brisk wind generally precedes rain.

It is a sign of continued fine weather when the wind changes during the day so as to follow the sun.

Winds changing from foul to fair during the night are not permanent.

If the wind is from the northwest or southwest, the storm will be short; if from the northeast, it will be a hard one; if from the northwest, a cold one; and from the southwest, a warm one. After it has been raining some time, a blue sky in the southeast indicates that there will be fair weather soon.

When the wind is in the north,
The skilful fisher goes not forth;
When the wind is in the east,
'Tis good for neither man nor beast;
When the wind is in the south,
It blows the flies in the fish's mouth;
But when the wind is in the west,
There it is the very best.

If there be a change of wind from the northwest or west to the southwest or south, or else from the northeast or east to the southeast or south, expect wet weather.

Always a calm before a storm.

When numerous whirlwinds are observed, the rotation being opposite to that of the sun, look for wind and rain.

GENERAL PROGNOSTICS.

Currents of air change their course frequently, in the higher regions of the air first, and are afterwards continued to the earth's surface; whence we can often foresee a change of wind by observing the clouds. Both the strength of the coming gale and the point

from which it will blow may usually be determined by noticing the velocity and direction of the clouds floating along in the upper currents.

Aurora.

The aurora when very bright, indicates approaching storm.

Barometer.

If it freezes and the barometer falls two or three-tenths of an inch, expect a thaw.

If the weather gets warmer while the barometer is high and the wind northeasterly, we may look for a sudden shift of wind to the south. On the other hand, if the weather becomes colder while the wind is southwesterly and the barometer low, we may look for a sudden squall or a severe storm from the northwest, with a fall of snow if it be winter time.

A sudden rise of the barometer is very nearly as dangerous as a sudden fall, because it shows that the level is unsettled. In an ordinary gale the wind often blows hardest when the barometer is just beginning to rise, directly after having been very low.

A rapid rise of barometer indicates unsettled weather. A slow movement the contrary, as likewise a steady barometer, which, when continued, and with dryness, foretells very fine weather.

Bells.

Bells are heard at greater distances before rain.

Camphor Gum.

Camphor gum is said to rise in alcohol before rain, and weather glasses containing it are very common.

Ears.

When there is a tingling noise in the ears, or what is called a singing in them, it is a sign of a change of weather, not simply of rain as has been said, but of barometrical pressure in general. The sudden increase of pressure, like the descent from high mountains, or from balloons, causes in many persons a temporary deafness and roaring in the ears. A sudden fall of the barometer affects also the ears, but in a different manner, like climbing a mountain.

Noises in the ears are frequently percursors of marked atmospheric changes.

Floors.

Floors saturated with oil become very damp just before rain.

Stones.

The marbles in western Vermont change color before a storm, as, like other stones, they become damp, causing the change. Dew on stones during the day indicates storm.

Fog; Smoke.

When with hanging fog smoke rises vertically, rain follows.

Headaches.

Headaches often indicate a change of weather in persons subject to such complaints. Indeed, most nervous disorders seem to be connected with some atmospheric changes.

Indications of Clouds.

After fine weather the first signs in the sky of a coming change are usually light streaks, curls, wisps, or mottled patches of white distant clouds, which increase and are followed by an overcasting or murky vapor that grows into cloudiness.

Pipes.

Pipes for smoking tobacco become indicative of the state of the air. When the scent is longer retained than usual, and seems denser and more powerful, it often forbodes rain and wind. A person being accustomed to take his pipe early in the morning will have occasion to observe that when the smoke hangs a long while in the air, and scents the place around where he has been smoking more than usual it indicates a storm.

Stomach.

This organ in persons of weak and irritable constitutions is often deranged at change of the weather, and its digestive powers are more under atmospherical influence than people are commonly aware of. Before storms it is particularly liable to uneasy sensations.

Toothache, Neuralgia and Rheumatism

are often the forerunners of comming storm, as the nervous system is very sensitive to atmospheric changes.

Winds.

Southwest to southeast winds are those most likely to be followed by storm in New England, and all such storms are preceded by fall of barometer, while with an east or northeast wind the fall may be very slight. Hence the first, clear on a low, but rising barometer, while the last may clear on a high, and almost immediately falling barometer. In December our early snows are most likely to come from northeast to northwest.

CONCLUSION.

Every farmer must study the atmosphere for himself, and by closely observing the hints here given, and by keeping a close watch of the progress of storms, as published by the signal service, he will seldom have a storm catch him unawares. Our chance of foreknowledge of the weather has certainly much improved of late; and concurrent laws of states in aid of the signal service of the war department, as before indicated, would save millions of dollars to Vermont farmers.

We are certainly far in advance of the time when Virgil penned the following lines; yet they showed the closest observation and thought:

SIGNS OF RAIN.

The cow looks up, and from afar can find
The change of heaven, and muffs it in the wind.
The swallow skims the river's watery face;
The frogs renew the croaks of their loquacious race.
The careful ant her secret cell forsakes,
And drags her eggs along the narrow tracks.
At either horn the rainbow drinks the flood;
Huge flocks of rising rooks forsake their food,
And, crying, seek the shelter of the wood.
Above the rest the sun, who never lies,
Foretells the change of weather in the skies;
For if he rise unwillingly to his race,
Cloud on his brow and spots upon his face;
Or if through mist he shoots his sullen beams,
Frugal of light in loose and struggling streams,
Suspect a drizzling day; * * *
If fiery red his glowing globe descends,
High winds and furious tempests he portends;
But if his cheeks are swolen with livid blue,
He bodes wet weather by his watery hue;
If dusky spots are varied on his brow,
And streaked with red a troubled color show,
That shallow mixture shall at once declare,
Winds, rain, and storms, and elements at war.

CLOVER.

By Dr. Hiram A. Cutting.

The artificial grasses, so-called, or the clover family is certainly one of the greatest boons to the husbandman. They have been cultivated in England for over two centuries, and much advantage has ever been derived from their cultivation. In 1770 some clover seed was brought to this country, and from that date it has been more or less the farmer's friend here, according as he has adopted its advantages. There are, however, several varieties. First in favor is

Trifolium protense, or Common Red Clover.

It is largely cultivated. The hay analyzes as follows:

ONE HUNDRED PARTS DRIED.	
Albumen, (Flesh producing)	22.55
Fatty Matters	3.67
Starch, Sugar and Gum, (Nitrogenous)	44.47
Wood fiber	19.75
Ash, (Mineral matter)	9.56
	100.00

T. Protense perrene—Perennial Red Clover.

Is a variety with a longer root, that penetrates more deeply into the soil, and hence is better for green manuring. It is extensively cultivated.

One hundred parts dried grass analyzed by Way, gave

Albumen, (Flesh producing)	19.18
Fats	4.09
Starch, Sugar and Gum, (Nitrogenous)	42.42
Woody fiber	25.96
Ash, (Mineral matter)	8.35
	100.00

While this is used more extensively by European farmers, it does not seem to be preferable to the conmon red in New England. Either gives a remarkable and profitable growth. No land where either can be raised need lose fertility, for two or three crops plowed in will wonderfully recuperate the most sterile soil.

T. Medium—Zigzag Clover.

This is quite different in appearance, but it is to be remarked that all the clover family are remarkably near the same standard of quality.

One hundred parts of dried grass assayed by Way, gave

Albumen	24.33
Fats	3.57
Nitrogenous material	36.36
Woody fibre	24.14
Mineral matter	11.60
	100.00

T. Repens—White Clover.

This spreading clover is common in Vermont, and seemingly indigenous to the soil, as it gets in everywhere. It is a superior pasture grass, and one that stays well in much of our Vermont pasture land.

ITS ANALYSIS IS WHEN DRIED,	
Albuminous, or flesh producing material	18.76
Fatty matter	4.38
Starch, Sugar, Gum, etc., (Nitrogenous)	34.04
Woody fibre	26.53
Mineral Matter	10.29
	100.00

From four to eight pounds of the seed I find of great advantage on all new seeding, and I also sow it liberally on old pastures (where there is no feed,) combined with land plaster. The results are everywhere good.

T. Hybridum—Alsyke Clover.

This bears the greatest resemblance to white clover, only the heads are pink, and it is of much larger size. It is said to be a hybrid. That it is a valuable and luxuriant plant all who grow it must admit. Its analysis is almost identical with the white clover, and so I omit it.

T. procumbens—Small Yellow Clover.

This small clover is a native of Europe, which has become extensively naturalized in some parts of the country, particularly in the middle and some of the southern states. It has a perennial root from which spring several procumbent, slender, branching stems. Under favorable circumstances it rises to a foot or more in height. The leaves are numerous but small, having a very short petiole, and composed of three obovate or wedge-obovate leaflets, which are notched at the apex and finely toothed on the margin, except near the base. They are from one-quarter to half an inch long, and the terminal or upper leaflet is short-stalked. The stipules at the base of the petiole are short and ovate. The heads are one-quarter to half an inch in diameter, composed of from fifteen to twenty small, bright yellow flowers, and are borne at the extremity of slender stems or peduncles one to two inches long.

This clover is valuable as a volunteer in uncultivated fields, but furnishes too light a yield for profitable culture wherever the common red clover will thrive.

I have had it brought to me several times in Vermont, and find that many consider it worthless. It is valuable, as it will grow on the most sandy soil. Its true value may be seen from analysis.

Its appearance may be seen in Plate xxii. The heads are hop shaped, and it is sometime called hop clover.

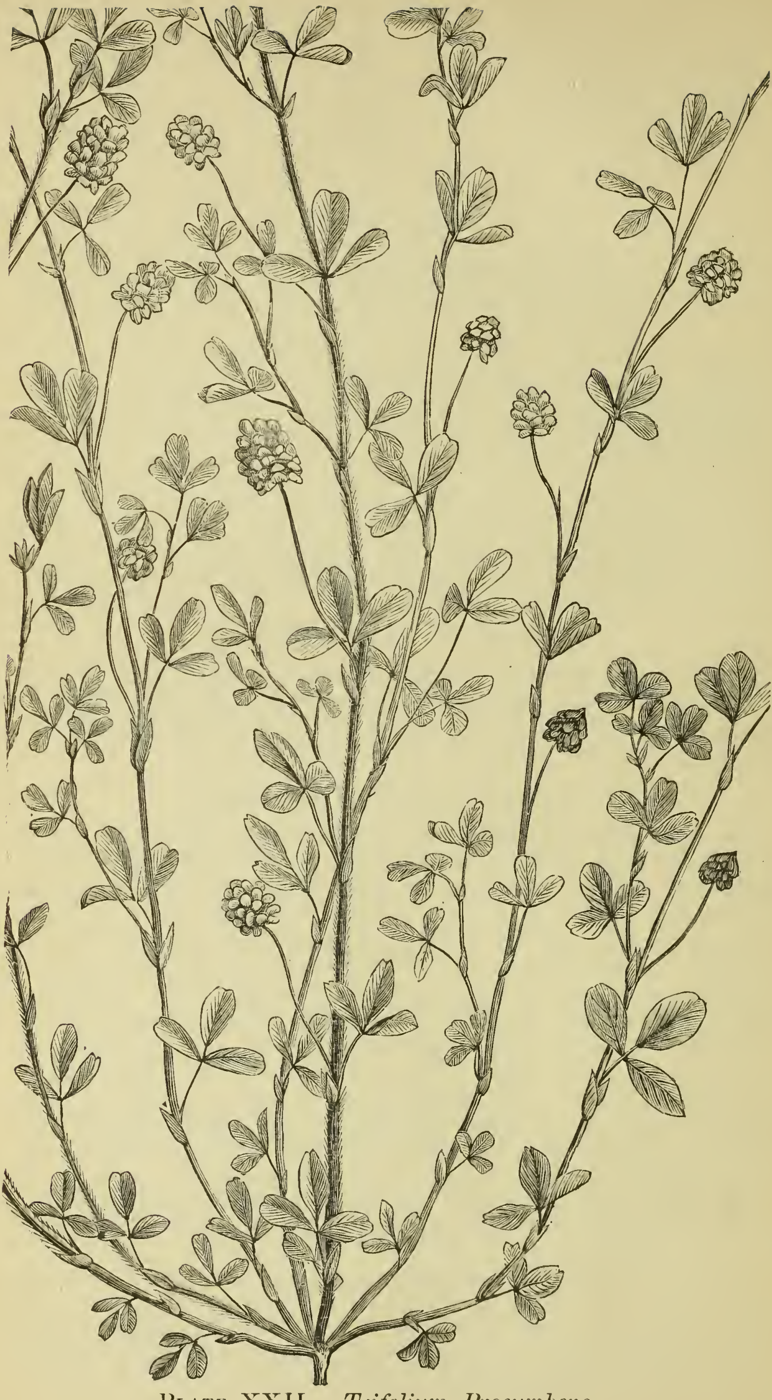


Plate XXII. *Trifolium Procumbens.*

ANALYSIS.

Albuminous material	20.48
Fatty matters	4.67
Heat producing principles, starch, sugar, etc	43.86
Woody fibre	22.66
Mineral matter,	8.33
	100.00

T. Filiforme—Common Suckling Clover.

Grows naturally, and on some dry, gravelly places as *T. procumbens.* Cattle do not so well relish it, yet it makes fair hay, but a small crop is all that can be raised of it; hence it is not in favor.

T. Incarnation—Italian Clover.

This is only cultivated for ornament, yet its analysis shows its value to be as that of other clovers.

T. Alexandrium—Egyptian Clover.

Is used some for an early spring crop, but much more in England than here. In fine, I have only seen it in gardens, and I do not think it well adapted for us.

Medicago lupulina—Hop medick, Black medick.

This plant has so much the appearance of small yellow clover (*Trifolium procumbens*) that a very careful examination is sometimes needed in order to distinguish between them. Their habit of growth is similar; the medick, however, is longer stemmed; the stems are more angular and hairy. Both have the flowers in small heads or clusters, and both belong to the clover family, but to two distinct genera. The main distinction is seen in the pods, which in *Trifolium* are small and generally included in the calyx, while in *Medicago* the pods are larger and bent or curved, in some species spirally twisted. In the black medick the pods are kidney-shaped, and when mature become of a blackish color. The leaves are very similar to those of the small yellow clover, but larger and broader. It is also a native of Europe, but has become extensively naturalized, and will often be found in the same field with the clover, generally spreading more extensively. In agricultural value it is probably about its equal.

I have written this short notice of the clover family to answer the many questions asked at our Institutes, and by letter and samples handed in so often, asking about the odd varieties found. These are all valuable and a more general use of the same for stock, and also in green manuring, would add many hundred thousands of dollars to the net income of Vermont farmers.

HOW PLANTS FEED, AND HOW WE CAN FEED THEM WITH FERTILIZERS.

By Dr. Hiram A. Cutting.

Plants receive nourishment somewhat after the plan of animals, and hence may be fed. That this feeding may be understood let us take a tree for example. It is fed, as far as man can feed it, through its roots. Instead of having one mouth it has millions, they mostly being near the ends of the little rootlets which are thrown out from its true roots and penetrate the soil for many rods in every direction. These correspond to the mouth in the human frame. Now, as in the human frame, the nourishment received through these tree mouths, the roots, passes to the lungs of the tree, and there, by contact with the air, is rendered fit to supply fresh growth to the tree. These tree lungs are the leaves. This operation is effected by the passage upward from the soil around the rootlets, through the roots, the trunk, the branches, and every twig of the tree to the leaves; of a large quantity of water, containing in solution the nutriment of the tree. Arriving at the leaves, a process takes place which separates, by means of contact with the air, most of the water the rootlets had taken in, from the valuable nutriment, and throws off into the air as vapor, the surplus water. At this time certain constituent portions of the air are utilized and mingled with the nourishment retained. This is now a small portion in comparison with what had arisen from the roots, yet retaining enough water to serve as a vehicle back, it is returned towards the roots, depositing in its way, in leaf, bark, and wood what is needed for the growth of the tree. Yet they undergo, especially in the bark, further fitting and digesting processes before they assimilate with the substance of the tree.

Now let us return to the leaf and contemplate the stomates, or mouths, through which the water evaporated and the carbonic acid and necessary gases entered. Of the extent of the provision made for evaporation by the leaves, some idea may be formed from a consideration of the number of *stomata* or stomates to be found in the leaves of plants. The number varies in different plants, for which variation a reason may be found in the different conditions of growth to which they are subjected in their several natural habitats. In the back of the leaf of the apple tree there are about twenty-four thousand stomates, to the square inch. In the leaf of the lilac there are a hundred and sixty thousand of them to the square inch. In the leaves of the cherry-laurel there are none on the upper surface of the leaf, but ninety thousand have been counted on the lower surface.

Thus it may be seen that nature in the tree works on a diminutive, as well as magnificent, scale. But it is the understanding of these provisions of nature that enables man to guide the growth of the plants he desires to cultivate.

Experience has enabled us to determine that in the domain of nature everything has its limit. So in the food of the plant, while it accepts its needs, it rejects what it does not require. and if compelled to feed upon it, like the poisoned animal, dies. Too much of what it desires even will cause an unhealthy development, like as in the animal, and it will fail to mature its proper seed, or become weak and unable to stand, in which case we say the soil was too poor or that it was too rich, and our crops lodged, etc., as the case may be.

A farmer in Westford, Vt., "burned a pile of brush in which was some bones, and sowed grass seed on the ashes. Result: Timothy six feet and two inches long, with heads nine inches in length by actual measurement."

Inadvertently he had added potash and phosphoric acid in just the proportions needed, and a perfect crop was the result. If he could have served a thousand acres in that way it would all have produced in the same manner. Now the query is, whether he will accept the result and use burned bones, fine ground, and ashes on his land and get such crops, or go back to the old method of using only barn manure.

But you will say I discourage the use of barn manure, which is the sheet anchor of New England husbandry. No, I do not wish to do that, but I wish all the farmers to understand that barn manure is not a perfect fertilizer, and that the actual waste from the excessive use of it in Vermont would, as my experients show, be ample to fertilize with slight additions every acre of cultivated land in the state. But you will say that you can't understand how I know this. I know it from experiment and observation. First, all admit that a lodged crop is not a perfect crop and every farmer is sorrowful to have his grain lodge, as he tells you it will not fill if it lodges. It does not fill for the same reason that it lodges. It is sick. From forty to sixty loads of barn manure has made it so, while from five to ten loads would not, and if in Westford, the addition of burned bone meal and potash would give a perfect crop. I have raised herdsgrass with heads eight and a half inches and standing five and one-half feet high, with the treatment I recommended to others; only potash however was needed, instead of potash and bone (phosphoric acid) as in the Westford experiment. (See Agricultural Report of 1861 and 62 for detail of experiments.)

From what I have said, it will be seen that the perfect plant is a healthful plant, and that means it has been properly fed. Now, when the farmer has, by these actual experiments upon small plots of ground, found out the best way, he almost always finds that his trouble is too much nitrogen, forcing, by its evolved ammonia, a too rapid growth, and a sickly condition. Stable manure is a nitrogenous fertilizer, and from that very excess of nitrogen he is limited to a comparatively small number of loads to the acre, and hence must, in connection, use bone meal, potash, salt; or the food that the land stands in need of, as developed by his experiments. If he does this he is sure of the best of crops, which means success.

METHOD OF APPLICATION.

This is of greater importance than would at first seem, but when we think that the fertilizer contains the food for the plant in a crude, and concentrated condition; and that it must first be dissolved in water and incorporated with the soil that when re-dissolved it may be taken slowly and surely by the plant, and that our summer rains are hardly sufficient to do the last work, the great importance of gaining a benefit from all the spring rains, as well as the snow of winter, is quite apparent. Hence all fertilizing material should be applied in winter or early spring—much before the land is fit to till, that the action of the spring rains may be of advantage in dissolving and distributing the plant food in the soil.

WASHING.

But say some, in this way we shall fertilize our river beds and not our farms. Experiment shows that there is little danger from this cause. It is in reality a bugbear that no one need be afraid of unless on land that overflows with the current of some stream that will take away bodily what you put there. I make this statement not only from experiments conducted in this line for eighteen years, but upon the testimony of many reliable men that have followed the course I indicate, with the best possible results. Do not be frightened until you are hurt, and have faith enough to try as I direct, and then you will know from your own experiments, that are more convincing than the best testimony. What I say of stable manure is true of all fertilizers, and the application in early spring at least is advisable in all you put upon your land, even land plaster.

POTASH AND PHOSPHORIC ACID.

But many say, "We understand the use of potash, and how in ashes or as potash salt we can use it separately, but we do not so well understand how we can get phosphoric acid. Phosphoric acid is in bones, and bones contain nitrogen, so we add to the evil if we have barn manure to use, up to the point where nitrogen injures us. That is true, but you can burn your bones and then grind them, or you can dissolve them with potash or ashes, and thus prepare them, or you can use the apatite or phosphate rock as you do land plaster, and it can be bought ground in the same way, and so fine as to be readily available. I believe the popular idea that it was worthless in that way prevented reasoning out the probable fact that when fine enough it would doubtless be slowly available, and in experiment this year I find it is so. It is doubtless acted upon by the carbonic acid in the soil, and thus made soluble as fine ground bone is. Mr. A. H. Ward of Bridgewater, Mass., in answer to an inquiry says:

"I have frequently tested and compared the Charleston phosphate in its natural state, but finely ground, also when combined with sulphuric acid, then called soluble; but in that condition it cannot be taken by plants, for, if it was, it would act corrosively on their tender tissues. In the soil it reverts to its original condition, except it is

now in the finest pcssible state of division. Bones cannot be ground fine without great expense; therefore, sulphuric acid is used as the most economical way of reducing them, but there is no difficulty in grinding the mineral phosphates to an impalpable powder by machinery, without the aid of sulphuric acid, saving the cost of that material and obtaining double the quantity of phosphoric acid in its natural state, but finely ground, at one-half the cost, and of equal crop-producing capacity with that treated with sulphuric acid. This is so easily demonstrated, and at such small cost by applying some of each to the soil and noting the resulting crops on equal portions of land, that it would have been more generally tried by farmers if they had not had it instilled into them by the manufacturers of fertilizers and the experiment stations that in phosphate of lime treated with sulphuric acid, the phosphoric acid was worth twelve and one-half cents a pound, while the same phosphoric acid in phosphate of lime, finely ground, was worth but three cents a pound, and in that form was not available for a crop."

Dr. T. H. Hoskins of Newport says: "The South Carolina phosphate, when ground fine like flour, is quite as soluble as bone, which cannot be ground so fine, owing to its greasy and gummy nature."

I trust another season many a farmer will try the Carolina phosphate fine ground like plaster, and note the results; and unless this year's experiments are misleading, the results will be highly satisfactory to all.

COMPLETE FERTILIZERS.

Of course, the potash or phosphoric acid of which we have spoken, or even both combined, are not complete fertilizers, and it is my opinion that the rule I have been taught by experiment, that perfect fertilizers, so called, were often a damage instead of a blessing, is true in more cases than is now believed. Yet, with your potash and phosphoric acid and stable manure you have a fertilizer that is nearer perfect than the hand of man has yet invented, or at least it does better by me. That all may be satisfied, however, I give some formulas by Dr. T. H. Hoskins for a perfect fertilizer which are indeed good. As they have been proved so in his own experiments.

"Raw ground bone contains both phosphoric acid and combined nitrogen, and when mixed with ashes the compound is a complete fertilizer. But raw ground bone contains a good deal of grease, which keeps out the water and prevents its decomposition in the soil. To cure this defect we mix the ground bone with the ashes (two or three barrels of ashes to one of bone) and pack the mixture firmly into barrels, making holes nearly to the bottom with a broomstick or hoe handle, and pouring in enough water to soak the mixture without making it leach. This dissolves all the grease, and also "cuts" or softens the nitrogenons animal matter of the bone, so that it is all ready for the plants to use. All can see that this is more easily and safely made, and a more complete fertilizer than one made with bone and acid. If three barrels of ashes are used to one of bone, it is well to keep one until the rest of the ashes mixed with the bone has taken effect; (one, two or three weeks, according as you have

time to wait, but the longer the better). Before applying it to land, turn out the mixture in the barrels, and with a shovel mix the reserved dry ashes with it. This makes it better to handle, and easier to spread. Use this mixture just as you would a purchased fertilizer, but in double the quantity.

FORMULA NUMBER TWO.

Two thousand pounds fine ground South Carolina phosphate	$25 00
Ten bushels unleached hardwood ashes	2 50
One hundred pounds sulphate of ammonia	6 50
Total	$33 50

Mix thoroughly by shoveling over six or seven times on the barn floor. It should be so mixed that, when finished, every spoonful will be like every other spoonful. Better go over it too many times than too few.

FORMULA NUMBER THREE.

Two thousand pounds fine ground South Carolinat phosphate	$25 00
Ten bushels unleached hardwood ashes	2 50
Three hundred and fifty pounds cotton-seed meal	5 25
Total	$32 75

Fertilizers made upon the above formulas will be found as effective in every respect, used cost for cost, on all farm crops, as good stable manure, and quite as lasting. They should be sown broadcast."

I append the formula used by one of the many manufacturers of superphosphates, that the farmer may see at least what he gets sometimes, or did at least, the past season.

First dissolved bone is manufactured as follows:

Bone, fine ground	100 lbs
Sulphuric acid	75 "
Water	40 "
Bone for dryer enough to make up	225 "

Of this dissolved bone is taken	800 lbs
Raw bone	100 "
Salt	100 "
Humus, or muck dried	800 "
Ashes	100 "
Plaster	100 "
	2,000 lbs.

Of course, this is mixed by machinery, which pulverizes it, leaving it in fine condition. The muck used was of excellent quality of itself, giving by analysis valuable constituents, and from this cause the superphosphate thus made stood fair in analysis, and gave the best of satisfaction—even better than the pure dissolved bone did on many farms.

While I still recommend the formulas given in the last report in connection with the fertilizers of the barn, I of course know if you try no experiments, but use by the guess process, perfect fertilizers are more sure, but I prefer certainty rather than guess, and do not as yet choose to pay for a fertilizing material that not only does no good, but actual damage.

PRICE OF FERTILIZERS.

A. H. Ward gives us the following prices of materials used in the attenuated goods so often sold; and yet they can be purchased as they are, at prices named:

Sulphate ammonia, 24 to 25 per cent	4 cents per pound.
Nitrate soda, 95 per cent	2¾ cents per pound.
Fine ground bone, 3½ to 4½ per cent. ammonia; 50 to 55 per cent. bone phosphate	$32 to $36 per ton.
South Carolina phosphate, ground, 25 to 28 per cent. phosphoric acid	$12 per ton.
No. 2 superphosphate lime, 15 to 16 per cent. soluble phosphoric acid	$20 per ton.
Acid superphosphate lime, 12 to 14 per cent. soluble phosphoric acid	$16 per ton.
Muriate potash, 50 per cent	$36 per ton.
Sulphate potash, 80 per cent	$30 per ton.

Dr. T. H. Hoskins says: "It is easy to see that by the use of these materials a fertilizer can be compounded by the farmer himself that will cost him much less than the selling price at the village agency, and one the composition and proportions of which he may be sure of."

It will be seen if you desire an acid phosphate the price is but $16 per ton, yet it contains from twelve to fourteen per cent. of phosphoric acid. Please notice how much the first class superphosphates as assayed by Prof. A. H. Sabin, state chemist, contain and draw your own inference.

Allow me further to say that Mr. H. C. Burleigh, a large importer of Hereford cattle in Maine, says, the price of fertilizers in England are much less than here as the farmers have a purchasing agent who, gives notice, through the agricultural press that sealed proposals for superphosphates, and such fertilizers as are wanted, will be received to such a date, with the right to reject any or all bids. The result is, all the large manufacturers send in their proposals at the lowest competing prices, with samples of the same. These samples are marked as per schedule A, B, C, etc., and sent to some competent chemist for analysis, who gives the money values of each sample. These fertilizers are purchased at from $16.54 to $21.85 per ton gross, 2,240 pounds. Here, in my opinion, is something worth looking into by the American farmers.

Their material is largely carried from this country, and cannot our manufacturers compete if our farmers were judicious in their purchase. Of course it is so. Then let farmers combine as there for their mutual benefit. We must have so-called commercial fertilizers; what harm in buying close as possible?

ANALYSIS OF FERTILIZERS.

By H. A. Cutting, M. D.

FERTILIZERS SOLD IN THE STATE IN 1883.

The following analyses by Professor A. H. Sabin, state chemist, include the average of three analyses, as directed by law. The samples were carefully drawn and largely, from different carload lots, that the average may be fair for farmer and manufacturer. The methods used, are determination of phosphoric acid in absence of iron and aluminum by uranium method; in presence of iron and aluminum by Pemberton's molybdate of ammonia method; potash, by precipitation with platinum chlorides, and nitrogen by combustion with soda lime. The latter does not give nitrogen present as nitrates, but is the common method. That the farmer may understand their relative value I figure their worth according to the Connecticut standard: Nitrogen at eighteen cents per pound, soluable phosphoric acid at ten cents, reverted phosphoric acid at eight cents, insoluble phosphoric acid at six cents, and potash at five cents. I adopt this, not because I consider it the best way to figure it, but because it is uniform with the tables printed by the Connecticut Experiment Station, and so comparisons can be made with their work. If it was to show the actual value of chemicals, this statement is nearly or quite twenty per cent. too high. If it is intended to show the actual advantages to the farmer, derived from his purchases, it is more than that much too low. It is at best an arbitrary standard, without reason for its basis, as it should represent the actual market value, or its actual average worth to the farmer. Should you subtract one-fifth, it would approximate actual value of chemicals; or, add one-third, and it will express near the advantage the farmer will gain from its purchase in average years. Yet both are only approximates, while the figured value is simply in conformity with custom.

I am sorry to add that some of the manufacturers have been slow to come under the strict requirements of the law. Two or three still persist in putting on 'Ammonia" or "Available Ammonia" instead of "Nitrogen" as the law provides. It is true that seventeen parts of ammonia are equal to fourteen parts nitrogen; yet it should be no excuse because the deception is small that it should be tolerated. But the terms are not true synonyms, and I would suggest that in future that farmers refuse to purchase such fertilizers as are not put up in exact accord with the statute, even if the variation is so small that they avoid prosecution.

License No. 1.

Bradley's XL Superphosphate of Lime, made by Bradley Fertilizer Co., Boston, Mass.

Valuable Ingredients.	Per cent.	Pounds in a Ton.	Common Standard.
Nitrogen	2.6	52.	$9.36
Soluble phosphoric acid	7.2	144.	14.40
Reverted phosphoric acid	2.2	44.	3.52
Insoluble phosphoric acid	2.9	58.	3.48
Potash	2.1	42.	2.10
Estimated value	...	...	$32.86

License No. 2.

B. D. Sea Fowl Guano, manufactured by Bradley Fertilizer Co., Boston, Mass

Nitrogen	2.8	56.	$10.08
Soluble phosphoric acid	7.1	142.	14.20
Reverted phosphoric acid	1.5	30.	2.40
Insoluble phosphoric acid	2.3	46.	2.76
Potash	3.1	62.	3.10
Estimated value	...	...	$32.54

License No. 3.

Quinnipiac Phosphate, by Quinnipiac Fertilizer Co., New London, Conn.

Nitrogen	3.	60.	$10.80
Soluble phosphoric acid	4.8	96.	9.60
Reverted phosphoric acid	4.65	93.	7.44
Insoluble phosphoric acid	1.05	21.	1.26
Potash	2.3	46.	2.30
Estimated value	...	...	$31.40

License No. 4.

Original Coe's Phosphate of Lime, made by Bradley Fertilizer Co., Boston, Mass.

Nitrogen	2.6	52.	$9.36
Soluble phosphoric acid	7.5	150.	15.00
Reverted phosphoric acid	2.5	50.	4.00
Insoluble phosphoric acid	2.1	42.	2.52
Potash	2.	40.	2.00
Estimated value	...	...	$32.88

License No. 5.

Bay State Bone Superphosphate, made by J. A. Tucker & Co., Boston, Mass.

Valuable Ingredients.	Per cent.	Pounds in a Ton.	Common Standard.
Nitrogen	2.20	44.	$7.92
Soluble phosphoric acid	6·6	132.	13.20
Reverted phosphoric acid	4.6	92.	7.36
Insoluble phosphoric acid	3.3	66.	3.96
Potash	0.	...	....
Estimated value	...	...	$32.44

License No. 6.

E. Frank Coe's Bone Superphosphate of Lime, manufactured by J. A. Tucker & Co., Boston, Mass.

Nitrogen	2.3	46.	$8.28
Soluble phosphoric acid	7.3	146.	14.60
Reverted phosphoric acid	2.1	42.	3.36
Insoluble phosphoric acid	3.0	60.	3.60
Potash	0.3	6.	.30
Estimated value	...	...	$30.14

License No. 7.

Ammoniated Bone Superphosphate, manufactured by L. L. Crocker & Co., Buffalo, N. Y.

Nitrogen	2.84	56.80	$10.22
Soluble phosphoric acid	6.35	127.	12.70
Reverted phosphoric acid	2.10	42.	3.36
Insoluble phosphoric acid	1.87	37.40	2.24
Potash	2.2	44.	2.20
Estimated value	...	...	$30.72

License No. 8.

Potato Phosphate, manufactured by L. L. Crocker & Co., Buffalo, N. Y.

Nitrogen	2.42	48.40	$8.71
Soluble phosphoric acid	5.40	108.	10.80
Reverted phosphoric acid	2.52	50.40	4.03
Insoluble phosphoric acid	2.05	41.	2.46
Potash	6.05	121.	6.05
Estimated value	...	...	$32.05

LICENSE No. 9.

Soluble Pacific Guano, manufactured by Pacific Guano Co., Boston, Mass.

VALUABLE INGREDIENTS.	Per cent.	Pounds in a Ton.	Common Standard.
Nitrogen	3.11	62.20	$11.20
Soluble phosphoric acid	5.8	116.	11.60
Reverted phosphoric acid	4.3	86.	6.88
Insoluble phosphoric acid	2.	40.	2.40
Potash	2.5	50.	2.50
Estimated worth	...	...	$34.58

LICENSE No. 10.

Cumberland Superphosphate, manufactured by Cumberland Bone Co. Portland, Me.

Nitrogen	2.2	44.	$7.92
Soluble phosphoric acid	5.4	108.	10.80
Reverted phosphoric acid	5.2	104.	8.32
Insoluble phosphoric acid	2.8	56.	3.36
Potash	2.4	48.	2.40
Estimated value	...	...	$32.80

LICENSE No. 11.

Homestead Sugar Phosphate, manufactured by Michigan Carbon Works, Detroit, Mich.

Nitrogen	2.1	42.	$7.56
Soluble phosphoric acid	6.8	136.	13.60
Reverted phosphoric acid	2.6	52.	4.16
Insoluble phosphoric acid	1.3	26.	1.56
Potash	1.4	28.	1.40
Estimated value	...	..	$28.28

LICENSE No. 12.

Bowker Hill and Drill Phosphate, manufactnred by Bowker Fertilizer Co., Boston, Mass.

Nitrogen	2.8	56.	$10.08
Soluble phosphoric acid	6.	120.	12.00
Reverted phosphoric acid	2.1	42.	3.36
Insoluble phosphoric acid	2.6	52	3.12
Potash	1.6	32.	1.60
Estimated value	...	...	$30.16

License No. 13.

Stockbridge Manure, manufactured by the Bowker Fertilizer Co., Boston, Mass.

Valuable Ingredients.	Per cent.	Pounds in a Ton.	Common Standard.
Nitrogen	2.8	56.	$10.08
Soluble phosphoric acid	6.1	122.	12.20
Reverted phosphoric acid	1.4	28.	2.24
Insoluble phosphoric acid	2.2	44.	2.64
Potash	3.4	68.	3.40
Estimated value	...	...	$30.56

License No. 14.

Common Sense Fertilizer Co., No. 2, manufactured by Dole Common Sense Fertilizer Co., Boston, Mass.

Nitrogen	2.2	44.	$7.92
Soluble phosphoric acid	0.9	18.	1.80
Reverted phosphoric acid	3.8	76.	6.08
Insoluble phosphoric acid	2.0	40.	2.40
Potash	3.2	64.	3.20
Estimated value	...	...	$21.40

License No. 15.

Common Sense Fertilizer [D], manufactured by Dole Common Sense Fertilizer Co., Boston, Mass.

Nitrogen	1.4	28.	$5.04
Soluble phosphoric acid	0.5	10.	1.00
Reverted phosphoric acid	2.5	50.	4.00
Insoluble phosphoric acid	1.6	32.	1.92
Potash	1.6	32.	1.60
Estimated value	...	...	$13.50

License No. 16.

Slack Bone Phosphate, manufactured by Slack Fertilizer Co., Springfield, Vt.

Nitrogen	1.7	34.	$6.12
Soluble phosphoric acid	2.2	44.	4.40
Reverted phosphoric acid	8.1	162.	12.96
Insoluble phosphoric acid	1.4	28.	1.68
Potash	4.0	80.	4.00
Estimated value	...	...	$29.16

License No. 17.

Dissolved Bone, manufactured by Slack Fertilizer Co., Springfield, Vt.

Valuable Ingredients.	Per cent.	Pounds in a Ton.	Common Standard.
Nitrogen	2.9	58.	$10.44
Soluble phosphoric acid	1.2	24.	2.40
Reverted phosphoric acid	9.1	182.	14.56
Insoluble phosphoric acid	3.6	72.	4.32
Potash	0.4	8.	.40
Estimated value	...	...	$32.12

License No. 18.

Bradley's Patent Superphosphate of Lime, manufactured by Bradley Fertilizer Co., Boston, Mass.

Nitrogen	2.6	52.	$9.36
Soluble phosphoric acid	7.8	156.	15.60
Reverted phosphoric acid	1.2	24.	1.92
Insoluble phosphoric acid	2.2	44.	2.64
Potash	2.2	44.	2.20
Estimated value	...	...	$31.72

License No. 19.

Bowker's Phosphate, manufactured by Bowker Fertilizer Co., Boston, Mass.

Nitrogen	1.9	38.	$6.84
Soluble phosphoric acid	7.1	142.	14.20
Reverted phosphoric acid	1.	20.	1.60
Insoluble phosphoric acid	2.1	42.	2.52
Potash	1.6	32.	1.60
Estimated value	...	...	$26.76

License No. 20.

Bowker's Dissolved Bone, manufactured by Bowker Fertilizer Co., Boston, Mass.

Nitrogen	1.8	36.	$6.48
Soluble phosphoric acid	6.4	128.	12.80
Reverted phosphoric acid	2.	40.	3.20
Insoluble phosphoric acid	1.9	38.	2.28
Potash	2.1	42.	2.10
Estimated value	...	...	$26.86

EXPLANATION OF TERMS.

Nitrogen is commercially the most costly of any fertilizing element. Organic nitrogen is the nitrogen of animal matter as well as vegetable, and is found in the decomposing material of either. It is immediately available from blood, meat, stable manures and decomposed vegetable matter, and but slowly available if at all from hair, leather, hoofs, etc ; hence some fertilizers that have the nitrogen furnished from the last mentioned materials analyze better than they prove in use. For this reason the manufacturer should state from what material he manufactured his goods, or the constituent parts.

Ammonia and nitric acid are the results of the alteration of organic nitrogen. They can be purchased as sulphate of ammonia, or as nitrate of soda.

Seventeen parts of ammonia or sixty-six parts of pure sulphate of ammonia contain fourteen parts of nitrogen. Eighty-five parts of nitrate of soda contain fourteen parts of nitrogen. Nitrogen is estimated at a value of twenty cents per pound.

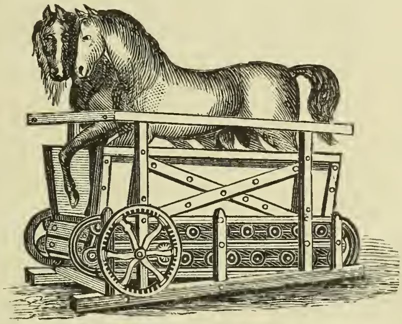
Soluble phosphoric acid implies that it is soluble in pure water. This is readily dissolved by the rain, and distributed in the soil that it may be taken up by plants. Its application requires great care that it may be distributed so as not to be too strong in places. If so, the rootlets of plants are injured and full benefit not derived. Estimated value ten cents per pound.

Reverted phosphoric acid means that it was once fully soluble in water, but from chemical change has become insoluble in pure water, yet experiment shows it is so in the impure water contained in our soils, but not as rapidly as if soluble. It is supposed that the soluble becomes reverted in our soil after having been dissolved, and then is more uniform in its availibility. If so, the reverted acid is more valuable than the strictly soluble, as its application is less difficult, and the danger of injury lessened. In this condition it is freely taken up by a strong solution of ammonium citrate, which is therefore used to determine its quantity. Those who claim it is not as valuable for fertilizing, claim that it is not so readily distributed by rain. Estimated value eight cents per pound.

Insoluble phosphoric acid. This is phosphate of lime as in bones, or as found in the phosphate beds of South Carolina, or the apatite rock of Canada. It is too coarse, too compact, to be dissolved either by water or ammonium citrate. If it is reduced to a very fine powder, it is however available, and if as fine as the reverted which has been made so by being once dissolved, I see no reason why it should not be as good as the reverted. I find by experiment that bone dust or the mineral when very fine is truly available, and I believe the farmer will by and by use it almost entirely in this way. Now valued from two and one-fourth to ten cents per pound. Estimated eight cents.

Potash. This is the fertilizing ingredient in wood ashes, and the base of various potash salts.

It is most costly as a sulphate, value seven cents per pound, and cheapest as a muriate or chloride, value four and one-fourth cents per pound. As in superphosphates, estimated at five cents. The foregoing are the ingredients from which the valuable part of the fertilizers sold are made up, though these desirable portions are, of course, obtained from material in its crude condition much cheaper than at market rates. This is the legitimate profit of the manufacturer, as the farmer would usually be compelled to buy in market. It is, however, desirable for any farmer to do so when he can make a saving thereby. If he cannot buy the compound desired he must prepare it himself or meet with loss. Let no farmer be afraid to test the capabilities of his land as he may and usually can, as a result, get much larger profits.



Horse Power, manufactured by E. Rollins, St. Johnsbury Vt.

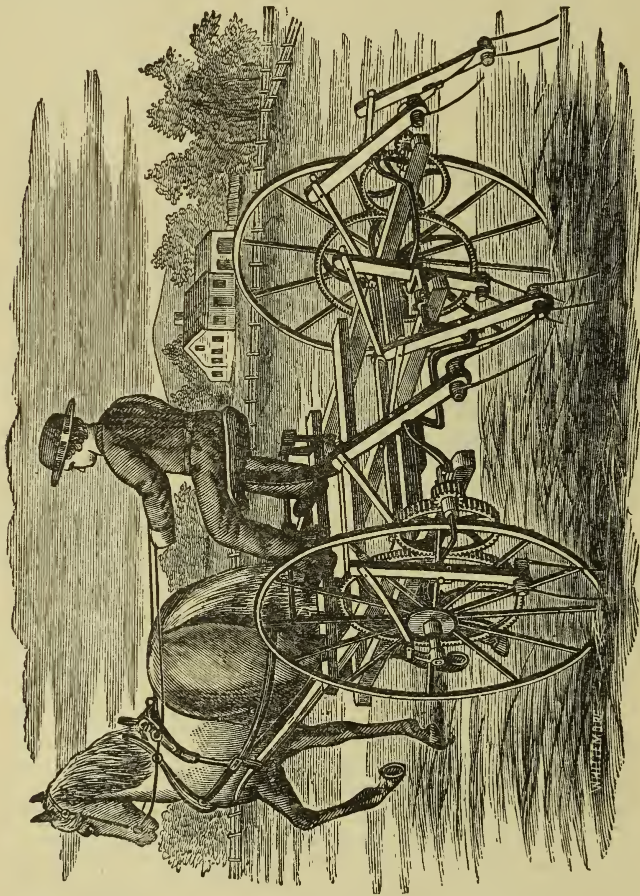
FARMING TOOLS.

By Hiram A. Cutting, Secretary.

Having received hundreds of letters in reference to various farming tools, dairy and sugar utensils, etc., I have been led to examine into the merits of the different manufactured articles, and can safely say of some of them that they are good. Of mowing machines, I will say, that all as far as I know do their work well on smooth ground, but for rough hill land, the strongest with the most flexible cutter-bar, or the one that can be best lifted without loss of motion seems best adapted for hill work, where rocks, stumps, etc., are plenty, and with such a machine I have been astonished at the capabilities of man and machine when ingenuity and Yankee skill guided the team.

HAY TEDDER.

Next to the mower comes the hay tedder. After due trial, I believe on rough land the "Bullard improved" the best, and while I have not run it myself on the smoothest land, I think it does the best work even there. I have seen one of those tedders pay for itself in a single day by constantly teddering some fifteen tons of hay, until it was dry enough to put in the barn, when without it it could not have been, and the ensuing rain preventing adjoining farmers one full week from securing hay left out, during which time it was nearly ruined.



BULLARD HAY TEDDER.

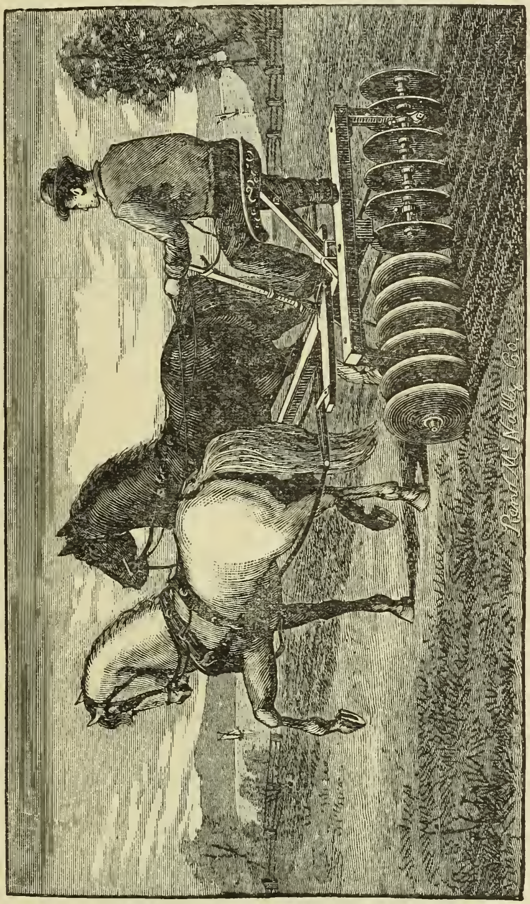
Manufactured by Belcher & Taylor, Agricultural Tool Company, Chicopee Falls, Mass.

THE HORSE RAKE.

Various patterns, all of which have good points, and many of them can be used on very rough land, to great advantage. Many a farmer could use them with great profit could he be educated a few hours by an expert. I believe their more general use desirable.

THE HARROW.

There are more questions asked about, and more difference in the harrows used, than in most other tools. In my belief two kinds are indispensable. The smoothing harrow, so-called, where the teeth



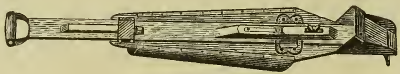
CORBIN HARROW.

Manufactured by the St. Lawrence Manufacturing Co., Gouverneur, N. Y.

are small, numerous, and stand backward at an angle; and the wheel or disc harrow. Of the last there are several varieties, some of which have serious defects. My experience would indicate that the "Corbin harrow" so called, gives the best results for the money. As far as I know it has given entire satisfaction.

PLANTERS.

There are numerous devices for sowing and planting everything from the finest grass seed, to cutting and planting potatoes at same time. All have merits, but none seem so perfectly adapted to the hill farm as Macomber's hand, corn, bean and beet planter. It is simple and perfect in working, and the saving in labor great. It is really the greatest improvement for the least money I have ever become fully acquainted with.



PLANTER.

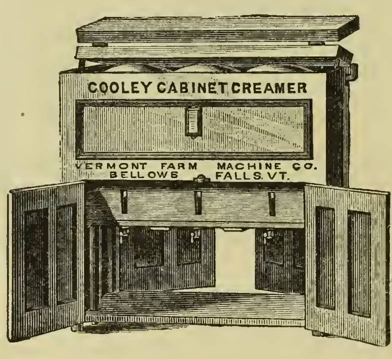
Manufactured by S. M. Macomber & Co., Grand Isle, Vt.

DAIRY UTENSILS.

Various means of aerating milk have been devised, but, H. D. Thatcher & Co. of Potsdam, N. Y., make a milk pail with rubber cases for the teats of the cow so that milk can be drawn without being contaminated by any odor from outside. Much to my surprise it works well. But the rubber cases must fit the teats, otherwise it is very inconvenient.

CHURNS.

I hardly dare venture an opinion upon the setting of milk, as I find thus far defects in all methods. Labor saving is one of the greatest gains. I give a cut of one of the devices manufactured by a reliable company, and I presume among the best of all yet; I have had no actual experience with it. They will gladly give all who enquire necessary information.

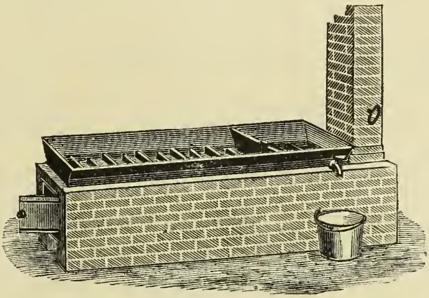


In relation to churns I feel more decided as the result of my own experience and the majority of opinions expressed at our Institutes favor the barrel churn. Many others are good, but this is excellent.

SUGAR MAKING.

One of the most valuable farm industries of Vermont is the manufacture of maple sugar, and the simplest device, by the means of which the sap can be directly and rapidly converted into sugar, is, as I believe, the best for the purpose.

Such a device is the evaporator manufactured by the Vermont Farm Machine Company of Bellows Falls. (See cut below.)

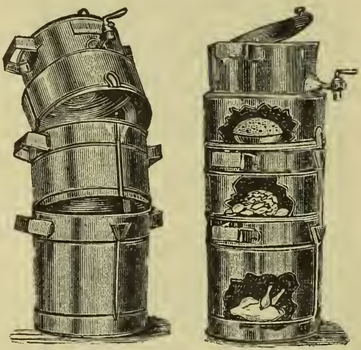


STEAMING FOOD.

Of late cooking by steam has received much attention, and the digestibility of food thus prepared is beyond question. Many ordinary devices are sold by means of which this may be accomplished, but of all I have seen the "Johnson Improved Steamer" is the nearest perfection. It is very desirable for use on oil stoves, and is not

excelled, as far as I know, by any steamer in the country. It is manufactured by the National Cooking Steamer Company, Lancaster, N. H.

I give two cuts, one showing the food in position. They will be glad to correspond with any one in relation thereto, and I believe put them out on trial.



Some of the advantages are that an entire meal, including tea and coffee, can be prepared at once, and with little attention.

Societies for the Advancement of Agricultural Pursuits in the State.

Vermont Dairyman's Association.

President, John B. Mead, Randolph.
Secretary, O. M. Tinkham, Pomfret.

Vermont Merino Sheep Breeders' Association.

President, Samuel James, Middlebury.
Secretary, Albert Chapman, Middlebury.

Vermont Merino Sheep Shearing Association.

President, J. L. Buttolph, Middlebury.
Secretary, Harrison F. Dean, West Cornwall.

Vermont Atwood Sheep Club.

President, Worthington C. Smith, St. Albans.
Secretary, George Hammond, Middlebury.

Merino Sheep Breeders' Union.

President, Bradley Fish, Ira.
Secretary, B. W. Marshall, Rutland.

AGRICULTURAL FAIRS.

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President, J. W. Worth, Shoreham.
Secretary, John A. Childs, Weybridge.

Caledonia Agricultural Society.

President, Asa S. Livingston, St. Johnsbury.
Secretary, I. W. Sanborn, Lyndonville.

Caledonia Fair Ground Company.

President, Ezra A. Parks, Waterford.
Secretary, Wm. P. Fairbanks, St. Johnsbury.

Champlain Valley Association.

President, LeGrand B. Cannon, Burlington.
Secretary, F. O. Kimball, Vergennes.

Coos and Essex Counties' Agricultural Society.

President, Geo. P. Rowell, Lancaster, N. H.
Secretary, I. W. Quimby, Lancaster, N. H.

Dog River Valley Fair Association.

President, Dana H. Morse, Randolph.
Secretary, W. W. Holden, Northfield.

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President, Bart Whitney, Franklin.
Secretary, Jacob H. Stufflebean, East Sheldon.

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President, Henry Harrington, South Hero.
Secretary, Stephen P. Gordon, Grand Isle.

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President, George W. Hendee, Morrisville.
Secretary, A. A. Niles, Morrisville.

Mad River Valley Agricultural Society.

President, B. D. Bisbee, Moretown.
Secretary, A. D. Bragg, Waitsfield.

Orange County Agricultural Society.

President, Wm. H. Gilmore, Fairlee.
Secretary, J. H. Jones, Bradford.

Orwell Farmers' Club Fair.

President, Henry T. Cutts, Orwell.
Secretary, H. D. Branch, Orwell.

Patrons of Husbandry Allen District Fair.

President, George W. Dimick, Windham.
Secretary, A. D. L. Herrick, Chester.

Poultney Industrial Society.

President, George L. Bliss, Poultney.
Secretary, R. J. Humphrey, Poultney.

Union Agricultural Society.

President, David W. Cowdry, South Royalton.
Secretary, E. O. Lyman, Tunbridge.

Vermont State Agricultural Society and Wool Growers' Ass'n.

President, Henry Chase, Lyndon.
Secretary, Henry Clark, Rutland.

Washington County Agricultural Society.

President, E. E. Andrews, Berlin.
Secretary, C. C. Eaton, Montpelier.

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President, William C. Bement, Barnard.
Secretary, Ora Paul, Pomfret.

White River Agricultural Society.

President, Charles N. Parker, Royalton.
Secretary, Ed. A. Maxham, Bethel.

ACKNOWLEDGMENTS.

It is but due to James Vick and Company, florists and seedsmen of Rochester, N. Y., that we acknowledge the favoritism of our frontispiece, and but fitting that we should acknowledge in behalf of the farmers the courtesies our institutes received in reduced fare, from the different railroads in our state, which has also materially aided us in our work. We would further extend thanks to the Deleware & Hudson Canal Company of New York, Boston, Concord & Montreal & White Mountains R. R. of New Hampshire; also to the Portland and Ogdensburgh; Eastern, Concord, and Boston & Lowell railroads for favors received.

Our thanks are also due to the Agricultural College at Burlington, for the valuable services of Loren P. Smith of Trumansburgh, N. Y., and for other assistance given us, as well as to many noble and generous citizens of Vermont that have welcomed us to their homes, and thus cheered us on our way, and enabled the Board to hold more meetings than the appropriation provided for. Our thanks are hereby extended to all.

HIRAM A. CUTTING, *Secretary.*

CORRECTIONS.

On page 47, superphosphate made by William Scales, should read 143 pounds acid, and cost $13.

On page 220, the Orchard Oriole is said to build a pendant nest. This description should belong to the Baltimore Oriole as the Orchard Oriole build their nest in the crotch of a branch (usually apple), and a similar nest to the Kingbird.

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